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1921—1946

Being the silver jubilee of our appointment to the Editorial chair of the FOUNDRY TRADE JOURNAL, the time seems appropriate to review briefly some of the changes which have taken place during that period. In 1921 business was slack following the post-war boom. The Institute of British Foundrymen had just received its Royal Charter and held its annual conference at Blackpool under the Presidency of the late Mr. Oliver Stubbs. Then, there were the beginnings of international co-operation by the presentation of the first American exchange Paper, written by Mr. Elliott on some phase of electric furnace practice. Very few Papers were read, but there was a visit to the Barrow works of Vickers. The Institute was virile, but lacked adequate support from the foundry owners, with some enlightened exceptions. Generally speaking, the work was being carried on by the foundry manager type.

In the ironfounding industry, employers' federations existed, but preferred to eschew the limelight. In other sections they had still to be born. Foundries were equipping themselves with machinery of various types, but mechanisation was not discussed. The founding of aluminium was well established, but magnesium had scarcely left the experimental stage. Sand control, now considered essential, was talked of but not widely practised. Here and there the foundries had installed chemical laboratories and regarded themselves as the " cat's whiskers." The major control of ironfounding technology at that time must be credited to the technical representatives of the pig-iron manufacturers, as they undoubtedly helped the practical foreman to arrange his mixtures so as to suit current needs. Of course, the most up-to-date firms were making " semi-steel "—a name now seldom used. High-duty irons —especially alloyed cast-irons—were being studied by a few enthusiasts in their laboratories, and began to take shape about 10 years later. The steelfounders were badly hit by the slump (a condition made worse by insensate price cutting). Yet, in spite of this, they were conducting researches of real potential worth, whilst failing to get them over to the foundry floor. There were no X-ray examinations, and too few castings were cut up for internal inspection. The use of the camera was sadly neglected; there were, even then, more microphotographs than technological pictures of castings. It was seldom we received any typewritten articles for publication, and illustrations were often scrawls on the backs of envelopes. We confess that the trade—it was our notion to transform that appellation to " industry "—was still largely old-fashioned and narrow-minded. One of the earliest leaders we wrote was an appeal to modernise the visiting cards used by the industry. They were truly dreadful! An early leader we wrote on " A Commercially Voiceless Industry," produced a minor storm and we were " carpeted " by the National Ironfounders' Employers' Federation, but after what we still think was a spirited defence, we participated in the largest bottle—about four magnums—of 1906, Möet et Chandon, and established a friendship which time has only served to strengthen. Looking back on those, for us, exciting times, and comparing them with to-day, we can honestly say that we believe the foundry industry of 1946 is better equipped mentally, metallurgically and mechanically, than the foundry trade of 1921, and we are proud to have been so closely associated with it during this period of metamorphosis.

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CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

FOUNDRY MECHANISATION

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—I have just had an opportunity of reading a broadsheet issued by P.E.P. (Political and Economic Planning), dealing with the textile machinery industry. This is an interesting document, worthy of study by all who are interested in the provision of castings for textile machines. The writers of the broadsheet draw attention to the fact that the most acute shortage in regard to labour appears to be in the ironfoundries and make some very sensible suggestions in regard to the modernisation of foundries. Then appears the following sentence: "Recruitment of workers should be stimulated by the greatly improved conditions created by mechanisation, while the same process should considerably reduce labour requirements."

With the latter part of this statement I find myself in considerable agreement. Sensible mechanisation will reduce labour requirements, and economies should undoubtedly result, although the heavy wear and tear on foundry plant should be treated as an essential debit item in such a scheme. I cannot, however, see for the life of me why mechanisation should result in greatly improved conditions. Mechanisation frequently accompanies the building of new foundries or the extensive reconstruction of old foundries, and conditions in most mechanised foundries are good. There are, however, hundreds of firms in this country whose product cannot be economically provided on a mechanised plant, and it is no service to the foundry industry to suggest that greatly improved conditions can only be created by mechanisation. The type of mechanisation which is frequently undertaken does not create better conditions but results in a worsening of conditions, with the result that steps are taken to improve ventilation, to suppress dust, as near the source as possible, and otherwise to provide the best possible working conditions. It is to be hoped that founders whose products do not call for extensive mechanisation will still seek to improve working conditions to the maximum possible extent. It is probably the case that such improvements would prove less costly than in the case of a mechanised plant.

It would be interesting to have the views of other readers on this point.

Yours, etc.,
G. M. MENZIES (Director).

North British Steel Foundry, Limited,
Bathgate, West Lothian.
July 15, 1946.

[The publication referred to is summarised on page 325.—EDITOR.]

INDUSTRY AND RESEARCH

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—During the recent Federation of British Industries conference on "Industry and Research," which as your readers will know was a notable success, exception was taken to a paragraph in Dr. Hosking's Paper on "Research and Quality," which appears to have been read to reflect adversely on the foundry industry, although I am certain that your readers will recognise that there was no such intention. The illustration commented on was selected primarily as an example of co-operative research between the industries, and the paragraph in question, which is based on the author's, and his department's, own experiences, has now been revised as follows:—

> A further instance where an improvement in quality has resulted from research is to be found in the metals industry. It was found, particularly during the war years, that under high pressures a proportion, not infrequently as high as 80 per cent. of ferrous and non-ferrous castings, were porous to fluids, such as water, petrol, or oil. This porosity was a source of difficulty, and resulted in the discarding of a large number of castings. It is, of course, true that only a minority of castings is required to withstand the conditions referred to, so that under normal conditions porosity is not a disadvantage and in no way detracts from the performance of the casting.

We have arranged with a London publisher to publish a book of the conference proceedings in the near future, and Dr. Hosking's Paper will appear in this book in the revised form.

A communicated contribution from the Council of Ironfoundry Associations as follows, will also be included in the book:—

POROSITY IN IRON CASTINGS

The Council of Ironfoundry Associations is interested in the manufacture of iron castings of all types, and while recognising that the method of filling castings withstanding high pressures to overcome any porosity, referred to by Dr. Hosking (see page 5) served its purpose during the war period, it is desired to point out that under normal conditions such a practice will not be expected to be necessary. Furthermore the procedure mentioned is not, as might have been understood, applicable to general foundry practice or to their products.

The cast-iron pipe section of the ironfoundry industry produces approximately 500,000 tons of cast-iron pipes per annum; the automobile casting section, another 100,000 tons; the boiler and radiator section, 75,000 tons; and malleable tube fittings and cast-iron flushing cisterns, 15,000 tons. All of these, by nature of the conditions under which they are designed, must be free from porosity, and they are all tested in the light of the service for which they are required to operate. The results of these tests demonstrate that the number of rejections on account of porosity is infinitesimal.

It is only desired to place this question of porosity in its correct perspective.

The Federation regrets that this misunderstanding should have arisen and wishes to assure the industry that there was no intention on Dr. Hosking's part of calling into question the quality of British castings.

Yours, etc.,
B. J. A. BARD,
Industrial Research Secretariat.

Federation of British Industries,
21, Tothill Street, London, S.W.1.
July 8, 1946.

[The original phrasing of the paragraph in dispute was so ridiculous that at the conference, we publicly designated it as "poppycock." The revised version is merely "balderdash."—EDITOR.]

CONTROL TESTS FOR GREY CAST IRON

Report and recommendations of Sub-Committee T.S.6. of the Technical Council

(*Continued from page* 297.)

The Spiral Test. The spiral test piece, various designs of which are shown in Fig. 25, 26, 27 and 28, is made in this form to give adequate length with space conservation. The pattern may be hand rammed or machine moulded. The test piece is 60 in. long and is suitably marked every 2 in. of its length so that after casting, the cope may be removed and the length in inches quickly recorded. To gain time in measuring length of run small risers or whistlers may be brought up through the cope at definite intervals but in this case there is the possibility of low results being recorded owing to a whistler being misrun.

The design shown in Fig. 27 has been specially designed for use in conjunction with single cast piston rings and is of approximately the same section as the rings and the running practice is similar. This pattern is machine moulded using the same sand as is used for the casting, and rapid measurement of results is effected by the use of a specially designed gauge.

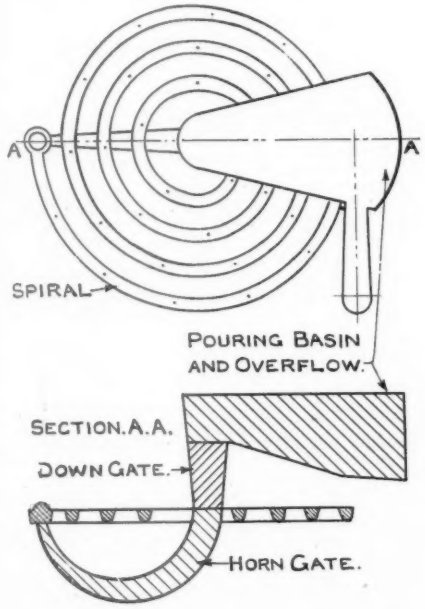

FIG. 25.—METHOD OF RUNNING SPIRAL TEST.

Section 2. Analytical Methods

The application of analytical control to cast iron before pouring is entirely governed by the time available. Thus rapid "bath analyses" may be taken from air, electric or rotary furnaces and from cupolas working with an efficient receiver. Analyses conducted on direct cupola metal may be conducted in time to indicate what corrective measures, if any, are required for subsequent charges and in rare occasions where very large castings are being made a ladle analysis for a particular element or elements might usefully be made.

In view of the urge for speed a high degree of accuracy may be possibly sacrificed, depending on the

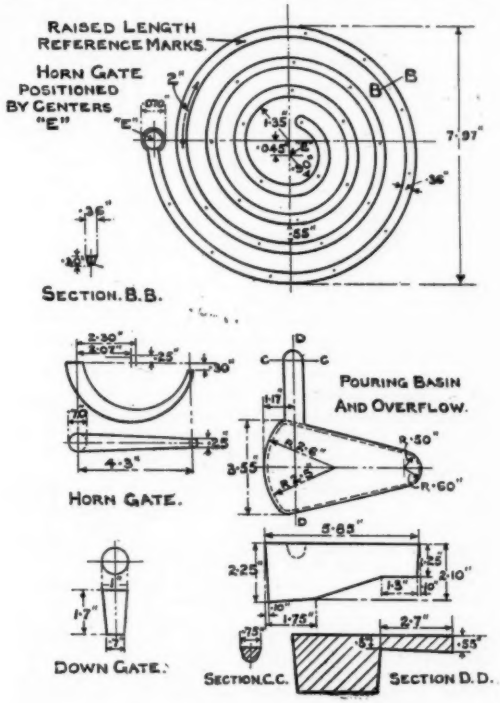

FIG. 26.—GIVING DETAILS OF MOULD FOR FLUIDITY TEST.

Control Tests for Grey Cast Iron

analytical tolerances permitted in each particular branch of the industry, but the methods recommended by the Sub-Committee permit high accuracies in the minimum time. The times given are based on actual practice in routine works laboratories and possibly are capable of improvement with practice and some inexpensive modifications of laboratory technique. For control purposes, the elements usually sought are carbon and silicon. More rarely S, P, Mn, Ni, Cr, Mo, Cu, Ti, Va, W and Al are sought and in specialised cases B, Zr, Te, etc., need to be determined.

The fundamental elements C and Si are generally of prime importance and their rapid estimation is usually considered essential. Unfortunately, in spite of the advances made in analytical chemistry and the introduction of physical methods, there is no one piece

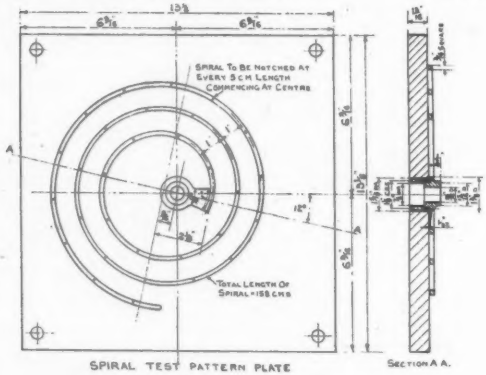
SPIRAL TO BE NOTCHED AT EVERY 5 CM LENGTH COMMENCING AT CENTRE
TOTAL LENGTH OF SPIRAL = 158 CMS
SPIRAL TEST PATTERN PLATE
SECTION A A.

FIG. 27.—SPIRAL TEST PATTERN PLATE.

of apparatus yet devised which will enable a rapid quantitative estimation of all the above elements to be made. The spectrograph is most versatile, but the non-metallics, *e.g.*, carbon, sulphur and phosphorus are impossible of quantitative estimation with the usual industrial instruments, whilst mechanical colorimetric methods can be applied only to elements which yield coloured solution or complexes. The determination of carbon by magnetic principles has been applied successfully to steels but there is little recorded work on its application to cast irons, mainly because of sampling difficulties, as the presence of graphite would naturally impair the results. Spot tests cannot be considered quantitatively and therefore purely chemical methods still find considerable application.

It is obvious that strict standardisation regarding the use of a particular method or specialised equipment cannot be made and therefore the founder must make his own selections from the description given below. This report is not intended as an analytical text book and the authoritative works such as suggested in the bibliography should be consulted as to details of procedure. In general analytical methods for cast iron may be classified as under:—

(*a*) Spectrographic methods;
(*b*) colorimetric methods employing mechanical; *e.g.*, photo-electric methods of colour comparison;

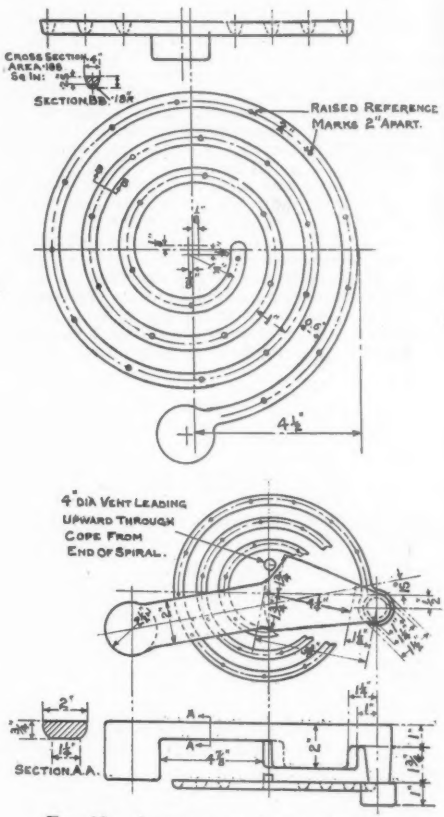

FIG. 28.—ALTERNATIVE SPIRAL TEST-PIECE.

(*c*) colorimetric methods employing visual comparison;
(*d*) normal wet chemical methods;
(*e*) spot test methods; and
(*f*) special techniques.

(*a*) SPECTROGRAPHIC METHODS.

The spectrograph as a metallurgical tool for the analysis of cast ferrous materials including cast iron is becoming increasingly popular. Published literature

on the uses of the instrument is quite prolific. Among its advantages of major importance is the speed with which analyses can be made. It is the most rapid and versatile method of analysis, is clean and easily operated and its low operating costs are an added attraction.

It is also a non-destructive method, consuming very little of the sample, consequently the necessity for drilling or crushing is avoided, simple surface preparation of the sample being all that is necessary. As before mentioned, the spectrograph, as far as cast iron analysis is concerned, suffers from a major disadvantage in that carbon, sulphur and phosphorus cannot, as yet, be conveniently estimated spectrographically. The method is normally applied to the determination of the following elements:—Si, Mn, Mo, Ni, Cr, and other minor metallics.

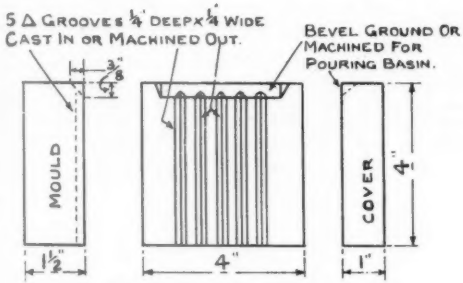

FIG. 29.—SAMPLE MOULD AND COVER (CAST IRON).

For ferrous analysis the large dispersion quartz spectrograph is essential. The installation costs of such an instrument together with its essential ancillary equipment, *e.g.*, microphotometer, are fairly high, and to the outlay on the instrument proper must be added the cost of buildings, including dark room, and the necessary photographic apparatus, consequently a fairly high output of work is necessary to justify its installation. Thus the spectrograph is most useful in a large works where many routine analyses on similar type materials are required. It would not be applicable, with any degree of justification, to the analysis of odd samples of widely differing composition. The accuracy of spectrographic analysis depends on the particular technique employed, but a good average figure for regular work would be plus or minus 2½ per cent. of the element sought.

For speed of operation, spectrographic anyalsis is, as yet, unequalled and without any elaborate arrangements one operator can comfortably analyse one sample for five elements in 15 minutes. Where there is a strong urge for speed this time can be cut, the Ford Motor Company has mentioned eight minutes as their usual practice for the determination of six elements in one sample. With two operators it is possible, under average conditions, to make 20 analyses of five elements per analysis in 2 hours. To the above times must be added the time taken to draw the sample. For cast iron the sample is preferably chilled, the most suitable form being a 2-in. long pencil which can be cast in a split mould and quenched to effect a saving in time. Another convenient form of sample is a 1-in. cube cast against a chill plate. The chilled face can then be prepared quite easily by simple grinding. The average time for drawing and preparation of the sample is 2½ to 3 minutes.

(*b*) COLORIMETRIC METHODS.

By far the greatest advance in colorimetric analysis over recent years is the introduction of mechanical means of measuring colour intensities. The instrument favoured in this country is the Spekker photo-electric absorptiometer and details of the operating technique of this instrument have been fully described in the literature and will not be reiterated here. Naturally,

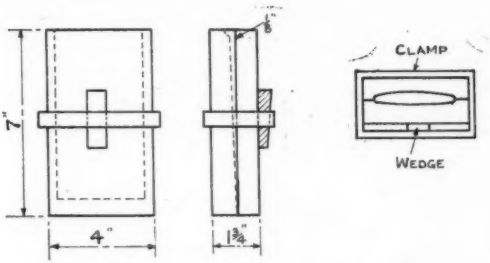

FIG. 30.—TYPE OF SAMPLE MOULD.

these methods can only be applied to elements the compounds or complexes of which yield coloured solutions. The elements usually encountered in cast iron analysis which fall in this group are silicon, phosphorus, manganese, nickel, chromium, vanadium and titanium. The minor elements nitrogen, copper, boron, bismuth and tellurium may also be determined.

Like the spectrograph, the instrument is used to best advantage under conditions requiring a large number of analyses; for the odd, or "spot" samples, little saving in time is effected compared with modern chemical methods. Unlike the spectrograph certain chemical operations must necessarily be performed prior to the actual use of the instrument, therefore a chemical laboratory and personnel trained in analytical technique are necessary. The instrument, therefore, becomes a useful adjunct to the routine chemical laboratory in avoiding errors due to the human element.

The advantages of the instrument are: (1) Very convenient, as it runs directly from the main electric supply; (2) photo-electric cells are robust and stable in response; (3) calibration curve for most elements over most concentrations is linear as the drum readings are on a logarithmetic scale; (4) the accuracy of the instrument is not seriously impaired by changes in the galvanometer, as this is a nil reading instrument; (5) as

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little as 7 ml. of liquid may be used, therefore micro-chemical methods are possible with accuracy; and (6) practicability of conducting a composite analysis on a single sample obviating loss of time due to weighing and subsequent separate operations.

A typical range of analyses which may be covered is: Mn, 0-1.5; Ni, 0-8.0; Cr, 0-15.0; Mo, 0-2.0; V, 0-1.0; and Ti, 0-1.0 per cent.

Si and P are troublesome to estimate, but it is reported that a method has been developed under very accurately controlled conditions with Si up to 2.0 per cent. and P up to 1.0 per cent. Sampling is identical to that used in the ordinary chemical methods as the analysis is done on drillings or crushings. Apart from Si and P, the other elements listed above may be estimated, employing a composite method, in 1¼ to 1½ hours, whilst a batch of 5 or 6 samples may be analysed for these elements in approximately 2 hours, thus again the apparatus is shown to be of greatest value in routine analysis. The apparatus is quite self-contained in a dust-proof cabinet. Regarding accuracy, colorimetric methods usually permit a higher degree of accuracy than the spectrographic method, this, of

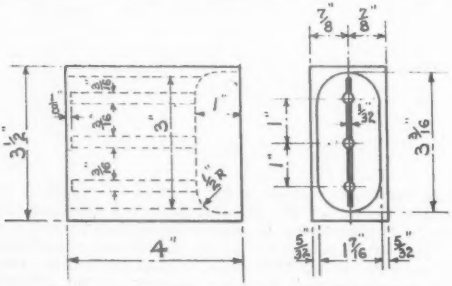

FIG. 31.—A THIRD TYPE OF SAMPLE MOULD.

course, depending on the particular element sought and its concentration.

(*c*) VISUAL COMPARISON COLORIMETRIC METHODS.

Visual or other mechanical means of colour comparison in analytical technique are in general use, but as most of these are well-known applications no special reference is considered necessary for the purpose of this report.

(*d*) NORMAL WET GRAVIMETRIC OR VOLUMETRIC METHODS.

In spite of the advantages to be gained from the introduction of spectrographic or mechanical colorimetric analysis it will be obvious that in cast iron analysis the purely chemical methods will still find considerable application, particularly for routine control purposes, where the accurate determination of carbon and silicon are usually of paramount importance. The main requirement of analytical control is the rapidity with which accurate analyses become available, and in all methods of analysis the sampling time must therefore be minimised.

Sampling.—Rapid and accurate sampling methods are very important. It is recommended that methods involving the casting of a test-block necessarily slow cooled to permit subsequent drilling, be discarded in favour of casting small chilled samples which can be crushed either by hand or mechanical means. This method not only results in a great saving of time but eliminates possible errors due to heterogeneity, particularly in respect of total carbon content where graphite loss may be encountered in a drilling operation, unless conducted under ideal conditions.

It should be noted that in chill sampling carbon losses may be as great as when drilling unless care be taken to ensure a completely white fracture. It has been found, however, that with the method shown in Fig. 30 even high silicon irons will solidify with such a fracture.

Any metal mould capable of producing a thin chilled wedge or rod may be employed and typical examples are given in Figs. 29, 30 and 31. Immediately after casting, such a sample may be removed and quenched prior to subsequent crushing. This latter operation is

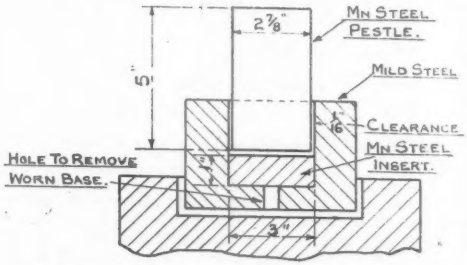

FIG. 32.—PESTLE AND MORTAR FOR CRUSHING SAMPLES.

done in a hardened alloy steel pestle and mortar, either by hand or mechanical means, typical sketches of the apparatus recommended being illustrated in Figs. 32 and 33. After crushing, the sample is sieved, preferably not coarser than 90 mesh and sufficient retained for subsequent analysis. Careful testing has revealed that no heterogeneity exists between the first and last positions to be crushed, hence the whole of the sample need not pass through the sieve. By hand 5 to 10 gm. of sample may be obtained in 5 minutes from the time the sample is drawn, whilst by mechanical means the same quantity may be obtained in 70 to 100 sec.

Laboratory Layout.—Before attempting to conduct rapid "bath" analyses, the laboratory should be so organised and equipped to permit the minimum delay in achieving the optimum speed of working. Such obvious precautions as having clean glassware readily available, muffles and hot plates to working temperature, filters and solutions already prepared, etc., are

often overlooked. The introduction of pad filters is considered highly desirable, as these permit more rapid and thorough washing where necessary. A rapid swing accurate balance or balances likewise are necessary and with good equipment and layout it is possible for two operators to submit accurate figures for carbon, silicon, manganese and sulphur in a maximum of 30 minutes from receipt of sample. The simultaneous analysis for nickel and chromium can be made in very little extra time, a third operator usually enabling the same time limit to be met, even with the addition of these elements.

A brief description of recommended rapid methods is given in Appendix B. No originality is claimed for any of the methods and their accuracy has been proved in practice with many diverse analyses.

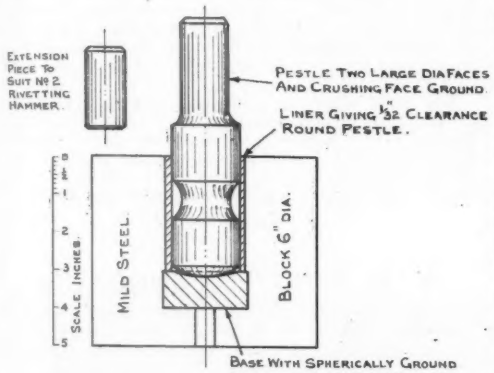
EXTENSION PIECE TO SUIT No 2. RIVETTING HAMMER.
PESTLE TWO LARGE DIA FACES AND CRUSHING FACE GROUND.
LINER GIVING 1/32" CLEARANCE ROUND PESTLE.
MILD STEEL.
BLOCK 6" DIA.
SCALE INCHES
BASE WITH SPHERICALLY GROUND FACE TO TAKE END OF PESTLE.

FIG. 33.—SUGGESTED CRUSHING APPARATUS.

(*e*) SPOT TEST METHODS.

Spot testing by purely chemical or electro-chemical methods is finding considerable application in distinguishing batches of mixed scrap, etc., but it is not sufficiently accurately developed to serve for a routine control method. The reader interested in spot testing technique has ample literature upon which to draw.

(*f*) SPECIAL TECHNIQUES.

With reference to specialised technique analysis, *e.g.*, methods based on electrical properties, these are not in general use in cast iron analysis. Naturally, any such method would of necessity be influenced by the graphite content of the material under examination and by the physical conditions of the matrix structure. Thus there seems little likelihood of such methods becoming popular for routine control for some time, but advances in the realms of electronics and supersonics may ultimately open up new and hitherto unexplored fields.

Section 3. Mechanical Tests

Mechanical tests capable of giving quantitative results on a comparable basis are tensile, transverse, impact and hardness which are here considered solely for control purposes. The correlation of control tests with inspection or acceptance tests is very important and the need for this is taken for granted. The tests enumerated are not assessed in any relative order of merit, this being determined by facilities available, time factor, importance of particular test, nature of casting, section thicknesses, etc.

Preparation of Test-pieces. All test-bars should be cast with as true and clean a surface as possible, but failing this they must be corrected by machining, the most rapid form of which is grinding. Reference should be made to an article * on grinding steel tensile test-bars using a wheel formed to the contours of the gauge length and shoulder radii. Any artificial speeding up of the cooling rate, even if done under most carefully standardised conditions, is to be regarded as unsatisfactory owing to the possible influence on structure and properties. This remark applies to all physical test specimens. The cooling time factor may be minimised by the use of small-scale testing apparatus with which test-bars of $\frac{1}{4}$ in. dia. (as-cast) with a correspondingly shorter cooling time, can be used to give comparative results.

Tensile Test. Little information is available regarding as-cast (*i.e.*, cast-to shape, unmachined) tensile test-bars for grey cast iron. An indirect measurement of tensile strength with a given grade of material, derived from a bend test, can be obtained with a degree of proximity from transverse tests. Tensile test-bars for control purposes should be cast singly in oil sand cores, or dry sand moulds, the design of which should be standardised, allowing for the differing diameters covering the section thicknesses concerned. With bars up to 1 in. dia. an average time of 20 minutes must elapse before the bar can be handled from the core without introducing undesirable cooling rates.,

Testing. Vee grips, if correctly aligned or of the self-aligning type, are the most rapid (as well as providing the most simple machining), but self-aligning, quick release grips using a headed bar are also quick and simple.

Transverse Test. This is probably the most useful test as it enables not only the bend test to be carried out but the brake-pieces can be subsequently machined for tensile, for hardness testing, and with certain reservations for impact test (see below). In this section the Tensometer bend test is to be included, but its use is limited to that type of iron which will not give unwanted structural constituents or transformations in a half inch or slightly larger diameter bar.

For the transverse test a bar of appropriate diameter, cast preferably in oil-sand, is prepared and can be broken in the testing machine within a very short space of time (depending upon the facilities available). With "skin-ground" bars, the closer the tolerance maintained upon the diameter, as-cast, the more readily are results comparable between successive tests, and

* "Iron Age," vol. 155, No. 3, January 18, 1945, p. 57.

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from varying sources. To obtain this basis of comparison the transverse modulus of rupture, not merely the breaking load, is the most suitable form of result. The deflection figure is of considerable value in assessing the nature of the cast iron tested. This test offers the most scope for a rapid control test. The preparation of transverse test bars is a very quick and simple operation, being at the most skin grinding.

Hardness Test.—This is the simplest test of all to carry out and can be done on suitably prepared bars, wedges or stepped blocks, the sizes of which are commensurate with the sections to be cast. The main time-consuming factors are solidification and cooling, particularly of the heavier sectioned test-pieces. Preparation by grinding is simple. The most commonly used machine is the Brinell and amongst others available are the Firth, Rockwell, Scleroscope, Vickers, and the tungsten carbide pyramid indentor recently developed by the B.C.I.R.A. and for which easier impression readings are claimed. The relationship between results of hardness tests on cast iron and other physical properties shows deviations when different types of testing apparatus are employed. It is important, therefore, that only one type of hardness tester be employed if comparative results are to be attained. Different types of machine may obviously be selected for different classes of work, but no resort to correction or conversion factors should be made, although approximate comparisons are available.*

Impact Test.—In the softer grades of iron the range of results obtained with the 0.798 in. dia bar does not make it a satisfactory means of tracing minor variations in consistency. With mixes to B.S. 786 Grade II and upwards it is likely to be of greater value; it should be realised, however, that there is not necessarily any direct relationship between impact and tensile and while impact might be used in determining consistency, it must not be taken as a measure of B.S. Grade. The final standing of this test is not yet settled, but certain points are known: (1) Test-pieces previously used for transverse testing may be used for impact testing as it has been shown† that previous stressing in the neighbourhood of the transverse fracture does not influence the Izod result; (2) with certain irons a separate test-piece is desirable for each impact; and (3) the recommended bar is to be machined from a 1.2 in. dia. cast bar, by grinding where facilities for such can save time over turning.

Bearing these points in mind the test requires at least one 1.2 in. dia. bar to be cast, and turned to finished size. The test itself is simply and rapidly carried out. The possibility or otherwise of using cast-to size, or close-to size bars for control purposes may warrant some investigation, in order to speed up the obtaining of results, but the use of such bars is not recommended for normal testing purposes.

* B.S. 860, 1939, Approx. Comparison of Hardness Scales.
†Everest, A. B., Grant, J. W., Morrogh, H., "The Development of a Single-blow Impact Test for Cast Iron," Iron and Steel Institute, Advance Copy, June, 1945.

Metallographic Methods

Speedy micro-examination of a sample cast under controlled conditions is largely a question of equipment and its location, together with skilled interpretation. The use of a series of micrographs of irons cast under the same conditions, but known to represent material which meets, or fails to meet, specification requirements is of great value. The examination of microstructures, however carefully carried out, yields results which, apart from measurement of average graphite size and number of flakes in a standard field, cannot be expressed quantitatively.

Acknowledgments

The Sub-Committee's chairman wishes to acknowledge the assistance given him by all members and, in particular, Mr. Hobson, who not only acted as chairman of the Sub-Committee for several months but was largely responsible for drafting the section on wedge, chill and shrink tests; Mr. Wright drafted the section on analytical methods and Appendix B; Mr. Payne that on physical tests and Appendix A; and Mr. Jones dealt with fluidity tests.

The Sub-Committee wish to express their thanks to Dr. J. E. Hurst and Dr. R. V. Riley (Staveley-Bradley Foster Research Laboratories), Mr. J. Arnott, F.R.I.C. (G. & J. Weir, Limited), and Dr. A. B. Everest (Mond Nickel Company, Limited) for assistance given in the preparation of various sections of this Report.

(*To be continued.*)

W. H. WHITTLE FOUNDATION

It is announced by the Institute of Vitreous Enamellers that the W. H. Whittle Foundation is being put into operation at once. This comprises an annual prize to be awarded by the Institute for Papers on enamelling subjects. The competition is confined to junior chemists or other technicians, but war service will be taken into account in regard to age. The premier award will be the W. H. Whittle medal in silver and enamel, carrying with it a cash prize of 10 guineas. The assessors reserve the right to award a prize to the runner-up in the case of specially meritorious Papers.

While any subject of interest to vitreous enamellers may be the subject of Papers, the following general topics will serve as a guide:—(1) Constitution of enamels; (2) preparation of metal surfaces; (3) application of enamels; (4) furnace technique, and (5) shop layout and aids to production. These do not exhaust the list of possible subjects, but for the guidance of those participating it may be mentioned that broad treatment of a subject will not be so favourably considered as specific examination of one phase of it.

Contributions are invited from non-members as well as members, but it is emphasised that competitors must be sure that they are not dealing with information which is confidential, except by permission. The closing date for entries in the present competition will be March 31, 1947, and entries should be sent to the hon. secretary, Mr. W. Thomas, Rickmansworth Road, Chorley Wood, Herts.

A DAY IN A STEELFOUNDRY

By VINCENT C. FAULKNER

The "day" really began on the previous evening, with a dinner appointment with Mr. D. Catton, a director of Catton & Company, Limited, Leeds. Mr. Catton was exactly three minutes late, but was readily excused when it was learnt that he had been to Leicester and back that afternoon. He regularly uses for business a three-seater plane, capable of a speed of 100 m.p.h., and a range of 300 miles.

The object of the visit was not to give an illustrated account of a well-equipped jobbing—yet partially mechanised—steelfoundry, but rather to ascertain how an enlightened foundry organisation functions under present-day conditions.

The firm of Catton is now controlled by the third generation of what has always been a family concern. The directors and the executive staff are young, whilst there is a complete recognition that their policy must align itself with the new conditions of this post-war world. What follows is an attempt to make a word picture of the *esprit* of the management. The firm does not possess a machine shop and to continue in business it must sell castings which will satisfy a wide range of customers. Thus the prime aim of the company is to strive unceasingly to provide an ever-improving level of quality. To accomplish this there must be complete control through co-operation by everybody. To achieve this co-operation there must be in existence the best amenities possible.

Quality control is divisable into two sections—the use of existing data, and the discovery of fresh facts, or in more usual terms, research. As the works are insufficiently big to undertake large-scale research, the management at least insists that it will do more than its fair share, and there is a target set that the resources provided shall produce a minimum of one Paper for the technical associations each year. For this object the scientific staff have available one of the best chemical laboratories the writer has ever seen. An attempt at streamlining has been successful. There is less apparatus on view, due to an admirable arrangement for storage. Hot water is on tap, and there are sinks at the end of the benches, as well as continuous slots. There are other laboratories for microscopic work and sand testing, and so forth. But that is not so interesting as the recording of results, and making them available to all and sundry. For this purpose recourse has been had to a series of rooms in the work yard, wherein are displayed, in the form of easily understood graphs, all the information garnered by the technical staff. The doors of these rooms are never closed, and the employees are daily finding an added interest in their work by following the trend of the curves. The technicians who assemble the graphs are available to discuss deviations from set standards, and this work is supplemented by meetings of interested parties in regular gatherings in the works library. The research and development programme (to which reference will be made later) demands, and is getting, the full co-operation of the practical man. For the figures germane to immediate production, such as the current properties of sand, metal and its tempera-

FIG. 1.—GREEN SAND FOUNDRY AT CATTONS.

A Day in a Steelfoundry

tures, these are immediately displayed for all to see. The sand used, by the way, is the synthetic variety, which permits of almost total re-use.

Apparently, for many years the firm has provided a canteen, but it is of the future to which thoughts are directed. The main shops are high and solidly built; obviously they have been blacked out. When the blackout is removed an effort will be made to raise natural lighting to the maximum. All piping is to be taken from the walls and placed in a trough underground, thus removing what the good housewife calls "dust traps." Already a "Sturtevant" vacuum cleaner is in daily service. The walls and machinery are to be coloured according to the advice given by an artist. The floors, with which good progress is being made, are to be concrete-covered with steel plates. Already the shops are commendably free from dust. The silica dust (emanating from mould paints) complex has received consideration, and the historic mixture has been entirely and successfully replaced by a zirconia paint. Mr. Cousans, the works manager, will detail the technique of the use of this material to readers interested in this phase of "safety-first" foundry practice. No further money is to be spent on re-equipment until the management is satisfied that the best working conditions have been instituted, unless, of course, some new plant is an important contributory factor. Moreover, until this programme is completed, no serious recruitment of apprentices is to be undertaken.

Research in Progress

At the moment there are two major pieces of research work in progress. The first is consequent upon the decision to suppress completely all dry sand moulding. This allows of a division of the work into three categories—(1) green sand; (2) skin dried, and (3) surface dried. The last grade is the most interesting, as it is based on the blowing of large quantities of heated air into the moulds. The writer has either forgotten or failed to appreciate the question of volume, but that established, there was the carrying out of a series of experiments to ascertain the most economical temperature. The graphs available clearly showed that there was no real advantage in taking the temperature much beyond the region of 315 deg. C. Next there was the job of finding out the time necessary for each mould mass, together with a number of allied experiments. However, the one which impressed the writer most was one which involved the testing for moisture at the surface, one, two, three and four inches remote from the surface at intervals of, say, 12, 24, 36, right up to 72 hours, because it was clearly established that moisture within the delay indicated *does not strike back*. This contradicts flatly a theory held by thousands of foundrymen all the world over. Another factor is that after surface drying there is a residual 1 per cent. harmless moisture content. Obviously, this is a type of research which appeals as much to the man in the shop as to the management.

The second research is as much for the benefit of the whole steelfounding industry as to the works undertaking it. This country knows more about the making of steel by small converters than any other country, but to maintain this lead research must be continuous. The particular piece of work which is being undertaken by Cattons, is the establishment of the best possible lining for converters. The system being followed is to carry out six life tests on their own particular mixture, and those of five other steelfoundries. These tests, which are not being done in any set order, have had the approbation of the appropriate committee of the British Steelfounders' Association, and every factor thought to be useful has been controlled. There are four thermocouples buried at increasing distances from the surface of the linings giving a continuous reading. The temperature of each cast is taken by an immersion pyrometer, and all germane details are registered. As data accumulate, they are from time to time reviewed by the committee. All the melting staff are interested, as they should be, in this worthwhile co-operative effort. The writer found a genuine source of inspiration in his visit and now that attention has been drawn to the spirit animating a modern industrial outlook, he hopes that many other concerns will take steps to create a similar forward looking policy.

USE OF MODELS

By "CHIP"

Models are very useful to designers when producing a new machine. These full-sized constructions reveal far better than numerous plans, sections and elevations, the actual appearance of the proposed mechanism. So, too, in a more detailed way, are models useful to the designer and those concerned in the manufacture of complicated castings, such as valve boxes for use with certain types of steam pump, etc.

Often, these castings contain a maze of passages twisting and turning in all directions, and it is very difficult, without an undue amount of drawing of sections and part sections, to visualise accurately the shapes of these passages at various points. The construction of a full-sized model of the casting, in which all the ports and passages are made of wood, and fitted in their respective places, leaving a space where metal is required in the actual casting, is of great assistance, not only to the designer, but also the patternmaker, moulder, coremaker and fettler. If each of the ports in the model is painted a different colour, the fettler looking at this could tell at a glance those cores which would be easy to remove, and also those from which he may expect difficulty, with twisted wires, etc.

The pattern-maker is aided in that seeing a model of the core, he can more readily decide on the joint of his coreboxes, and the best way of producing the core. The moulder can tell from such a model when to expect porosity from undue metal thickness, and prepare accordingly to combat this by means of feeding heads, risers or chills.

Although costing a little initially to produce, such models are a source of revenue in the ultimate saving of time when the job comes to be actually made, especially in the help it affords the various craftsmen.

AMERICAN NON-FERROUS FOUNDRY PRACTICE

Mr. G. Skript, managing director of Langley Alloys, Limited, has told readers of the Bulletin of the Association of Bronze and Brass Founders of his recent visit to the United States. One of the objects of this visit was to see various foundries in order to compare their technical achievements with those in this country and to study their production and sales methods and to obtain a picture how the industry is organised.

His first action was to visit their foundry association, which embraces within its membership some 300 ferrous and non-ferrous foundries. The subscription is 10 cents *per capita* employed per month, or a minimum of 90 dollars per annum. Quite a few members employ 600 or more people. The Association's main office is in Chicago, where are employed a manager, a foundry engineer, a public relations officer and two typists. The New York office consists of a manager and a typist. The Association assists its members in all technical and legal matters, particularly in dealing with the O.P.A. (ceiling prices). It carries out wage negotiations with the unions; issues information regarding costing, time study and rate fixing. It is their task to increase the efficiency of labour by means of propaganda.

Mr. L. E. Roark, the manager, expressed his regret that after this war no exchange of foundry missions between our two countries had taken place, as after the last war, and he stated that he would welcome it if such an exchange would be initiated by the Association of Bronze and Brass Founders.

Similar Technique

He inspected various foundries, the smallest one employing 38 people, the largest, 650 people, but they did not appear different from ours. The technique and production methods were more or less the same. The emphasis in every shop seen was on machine moulding, and all the shops had some mechanical handling equipment, such as roller conveyors and mono-rails for pouring. There was evidence of carefully thought-out layouts, the stress being put on saving skilled labour nad manpower generally. One manager stated he did not employ any skilled moulders or core-makers, the hand moulders being trained within six months to do the job. Another manager said they were producing 30 boxes per machine per hour, but were designing a new machine to make 100 boxes per hour—this would enable him to remain competitive with wages going up steadily. Moulding machines were of conventional type—snap flasks were much in evidence. Core-blowing machines were used extensively and a new bench-type cartridge core-blower was gaining popularity, this being sold for 300 dollars. Melting was carried out in electric furnaces of rocking-arc type, oil- or gas-fired crucible furnaces and in cupolas. In one shop where small brass castings were made, the melting was done in a cupola at the rate of 1 ton per hour.

The fettling plant consisted mainly of git cutters, band saws, cutting-off machines and grinders. Hand fettling was practically non-existent.

As far as could be roughly estimated from the scanty data available on cost computations, it appeared that the average earnings of the men in the shops was in the region of 2 to 2½ times that of ours, but their overheads being spread over a large number of direct labourers, they were kept at a fairly low level.

Their sales prices for machine-moulded castings were reasonable, but for hand-moulded castings, and particularly for dies and tools, they were extremely high, *e.g.*, pattern-makers' charges per hour were, including overheads and profits, calculated to be anything between 25s. and 30s. The industry did not seem to have settled down after the war, being troubled with strikes and disputes. According to the statements of some managers, the productivity of the shops was only 60 per cent. of pre-war. The impression gained was that, in spite of all the difficulties experienced at the moment, they will get going eventually. When the gigantic machine turns round, they will be formidable competitors in spite of their high wages.

CORRESPONDENCE

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

CAST-IRON SHELLS

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—With reference to the correspondence on page 238 of your issue of July 4, *re* cast-iron shells.

Peter S., of Sheffield, is "all at sea" in his suggested assembly method. It is obvious that the middle could not be moved after the core is placed.

Yours, etc.,
E. H. DAVIS.

Pattern Makers (Engineering) Company, Limited,
London, N.W.10.
July 9, 1946.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—With reference to the solution by Peter S. in your July 4 issue:—

The job's rammed up—we've made a start,
The core is placed in bottom part,
And then—we find we're in the cart!
And Peter S. must be smart,
To pass the core with middle part.

Yours, etc.,
LEONARD CLARKE.

6, Cul-de-Sac,
Bentley,
Willenhall.
July 8, 1946.

[We have received many other letters on the same subject, and these are being assembled to make a composite article.—EDITOR.]

RISING METAL PRICES

By "ONLOOKER"

At the commencement of this month the Ministry of Supply dropped its second price bombshell in three months, this time with an increase of £12 in copper, £10 in zinc, and the same amount in lead. Copper now stands at £84, zinc at £50, and lead at £55 (the last-named metal now being valued higher than it was after the first world war when a short-lived boom was enjoyed). Copper has not yet climbed to the point it touched at that time, but it is indeed possible that this metal will become much higher than it is to-day. The announcement by the Ministry coincided with news from America of the cancellation of O.P.A., and the removal of ceiling prices. As a result of this, both lead and zinc jumped up to 9½ cents, but no change has been reported in copper at 14⅜ cents, and there seems to be a tendency on the part of the producers to act cautiously. Obviously, they face the risk that if the quotation is lifted too far the miners will demand a wage increase, and so the trouble would start all over again. It is believed that the Government will clamp down again on price control in the United States, but it seems hardly possible that all the quotations can be put back to where they were before. Moreover, there is a body of opinion which thinks that a trial may be given to freedom of values, and it has been suggested that the results might not be as disastrous as has been expected from time to time.

Higher Scrap Quotations

In line with the upward movement in virgin metal prices, the Ministry moved up their quotations for scrap, these appreciating for the most part nearly to the full extent of the rise in the primary commodity. Copper scrap, for example, went up by £11, and brass by between £9 and £10, so that consumers, who have to face relatively higher monetary losses in melting their secondary metal acquisitions, are no better off, in fact, not so well off as they were before. On this occasion the list of secondary metal prices was made available on the same day as the changes in virgin metal prices were announced (an improvement on April, when a time lag of four days occurred). It is likely that purchases of scrap from the Government at the new prices have not yet gathered momentum, probably due to the fact that merchants have a certain amount of metal both ex Government depots and elsewhere, which they are prepared to sell at a shade on the official prices. It is interesting to note that the Ministry is prepared to pay for rough copper at £70, *viz.*, an advance of £12 on the previous price; in April, it will be remembered, their buying limit went up by only £5, and this caused a good deal of dissatisfaction in certain directions. For brass swarf the Ministry's price is £49 ex depot, and the market quotation stands at from £46 to £49, delivered buyers' works. Temporarily, there appears to be a lull in buying, but the mood of the moment is one of such excessive optimism that this will not last long. An increased demand has sprung up for scrap lead and remelted pigs, due probably to the fact that the Ministry of Supply is understood to have placed an embargo on the use of virgin for certain purposes. This remelted metal is believed to be commanding a price within £1 or so of the virgin price.

Lead Position Bad

The position in regard to supplies of lead is, of course, pretty desperate, so far as this country is concerned, and it is hard to believe that Britain has had anything like her fair share. Many people consider that the Government has failed badly in its buying organisation, and it is certainly a commentary on the system of bulk purchasing, that with lead standing at a record high price, the trade is struggling to exist on starvation rations. The truth of the matter would appear to be that those responsible for safeguarding the country's supplies of non-ferrous metals completely misjudged the outlook some 12 months ago, and have been underbought ever since on a bull market. It seems that manufacturers must now make do with remelted lead for a number of their products, always provided they are able to obtain supplies of a reasonably good quality. This state of affairs certainly does nothing to enhance the reputation of British goods on overseas markets.

NATIONAL EXHIBITION OF INDUSTRIAL DESIGN

The "Britain Can Make It" Exhibition, to be held in London from September 24, has been certified by the Board of Trade as an industrial exhibition for the purposes of the Patents and Designs Acts—1907-1946. Exhibitors may avail themselves of the protection afforded by these Acts by informing the Comptroller-General of Patents, Designs and Trade Marks, before exhibiting the invention or article to which designs are applied. Correspondence on this subject should be addressed to The Comptroller, Industrial Property Department, Board of Trade, 25, Southampton Buildings, London, W.C.2.

The duration of the exhibition, we understand, will depend on attendances, but it will run for not less than five weeks and not more than two months. Some 90,000 sq. ft. of the Victoria and Albert Museum will be occupied.

A two-day Conference on Design, under the joint sponsorship of the Council of Industrial Design and the Federation of British Industries, will be held in the Central Hall, London, on September 26 and 27.

This is the first of a series of conferences which the Council of Industrial Design propose to hold in association with the "Britain Can Make It" Exhibition.

Papers to be delivered at the four sessions of the two-day Conference will discuss the designer's place in industry, the design of machinery, design and research, and design as an ally in exports. Delegates will include designers and industrialists, and conference arrangements are in the hands of the Conference Secretary, Council of Industrial Design, Tilbury House, Petty France, London, S.W.1.

EXPERIENCES WITH BALANCED AIR FEED IN THE CUPOLA

By T. H. TAFT and H. A. HALLETT

(*Continued from p.* 270.)

Theory of Operation

It is generally accepted that the normal crucible shape inside the cupola is as shown in Fig. 11. The method of operation with low blast pressure flattens out the zone of maximum temperature, as indicated in Fig. 11. The optimum rate of melting to produce satisfactory metal is obtained after a little experience. Possibly the gas content is balanced in such a way as to give the soundest casting, consistent with a particular analysis. This point cannot be proved, but it is well known, and in the Authors' experience when using more than 30 per cent. of blast-furnace iron, the analysis can be perfect and yet severe shrinkage will appear

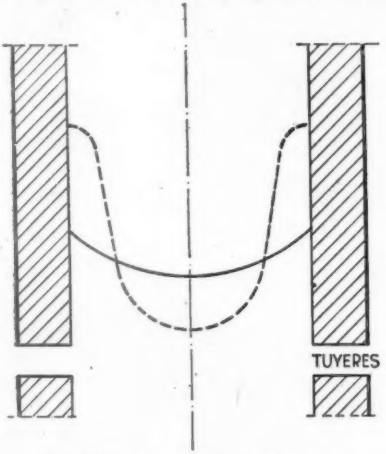


FIG. 11.—SHOWS THE FLATTENING-OUT OF THE ZONE OF MAXIMUM TEMPERATURE THROUGH THE USE OF LOW BLAST PRESSURE.

in the K-test bar. Inversely, too high a scrap figure has been found to result in fairly sound castings in general, with a slight tendency to shrinkage, but an increased tendency to form gas-holes.

One of the most important points in the design of a cupola is to provide an adequate preheating zone. It is considered good practice to hold one hour's melt in the cupola, say, with a 24-in. cupola this would probably mean on cylinder-type work a holding capacity of about 30 cwt. Should the lining wear (and it would not be considered excessive if it increased to 27-in. dia.), it might be thought that an hour's melt was held when fully charged, whereas in actual fact, to produce optimum conditions of melting, approximately 25 per cent. more air should be admitted to the cupola, with an appropriate increase in output. To go a little further and assume the wear just above the tuyeres at the superheating zone has increased the bore to 30 in., again air will be put through the cupola to produce conditions that will give 30 cwt. per hr., but the cupola should be melting at a minimum of 50 cwt. an hour to produce optimum melting conditions, so that this latter optimum melting rate would give approximately 30-min. holding capacity. These conditions would not be considered good practice, although the Authors do not think this particular point has been considered sufficiently in the past. Subsequent work proved that this point is very important, and was the main factor in deciding to carry out an investigation on lining wear, with the idea of reducing this to the minimum.

It may be of interest to mention that a considerable amount of high-duty cast iron has been produced from these cupolas. Normally, the steel mix has been 50 per cent. steel, 50 per cent. pig and runners, but a number of casts have been made with 75 per cent. steel with no detrimental results from gas-holes, which were a problem in the old days, probably due to over-blowing. The 50 per cent. steel mixtures are run with the coke ratio 6½ to 1 for producing total carbons of 3 to 3.1 per cent. at an extremely high temperature. The Authors have never been able to record the tapping temperature, as the silica sheath slags away before the temperature could be recorded. A number of instances where they have put 4½ per cent. of cold alloy into the ladle have still given ladle temperatures of 1,450 deg. C. Acicular irons have been produced frequently from this 50 per cent. steel mixture, and test-bars with very high figures have been obtained, but much more important is the result of bars extracted from 3-in. up to 5-in. sections, which have given tensile values between 24 and 27 tons, and impact figures of 19 to 23 ft.-lb. These, it should be emphasised, were taken from heavy-sectioned castings with an extremely slow rate of cooling.

To conclude with the cupola-operating portion of the Paper, two samples of standard material are shown in Fig. 12, incidentally, both taken from defective cylinders which were investigated for sand inclusions, and purely as a matter of interest this one is shown. It is thought to be a particularly good example of this class of defect, and a microphotograph is shown of this particular specimen under polarised light. Had this inclusion been slag, no reflection would show, owing to the fact that no free silica is present, and the negative would be completely black, grains of silica sand reflect fairly clearly. It is thought that improved structures are obtained from iron melted under the conditions outlined above, and a further idea is that tougher cast-

Balanced Air Feed in the Cupola

ings are produced from this slower method of melting, although this is a very difficult point to prove, it must be admitted.

Summary

To get the highest quality metal, it is necessary to find the optimum coke-burning rate of a particular size cupola, irrespective of the weight of the metal charges, and having established a set of conditions, if uniform results are required, it must be emphasised that the cupolas must be operated under those conditions, and the domestic arrangements in the foundry fitted in to take the molten metal at its proper rate. Maintaining this practice gives clean high-temperature metal, and a good metal-to-coke ratio.

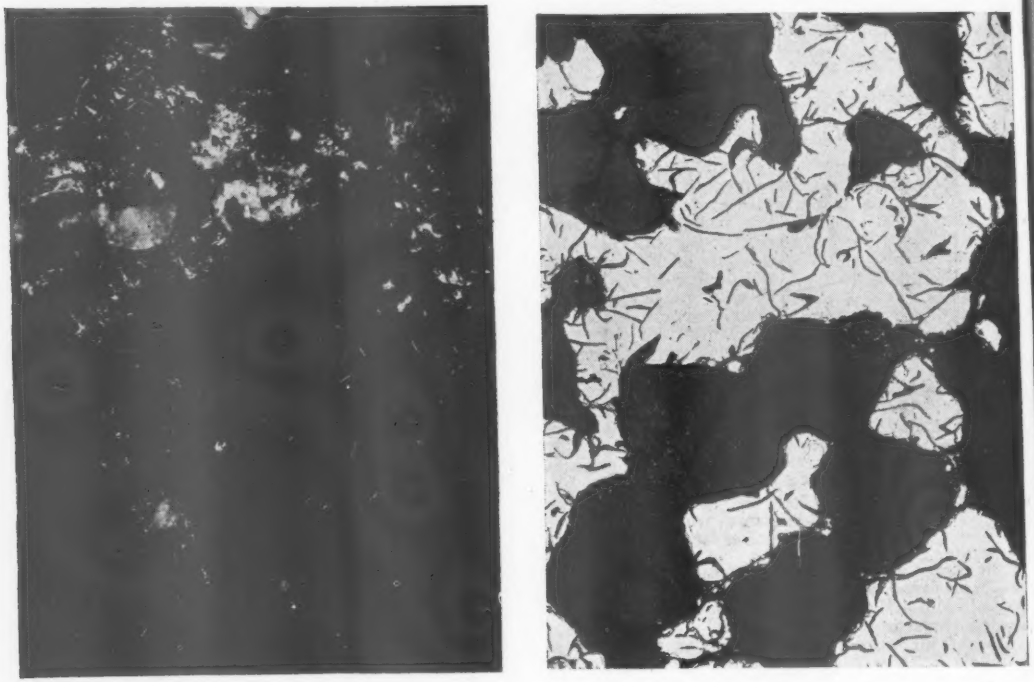
Continual molten metal tests are essential for control, and included in this is the K-bar test, which can be fractured within 10 min. from being cast, and after correct interpretation of the fracture of the K-bar, the likelihood of defective castings from shrinkage, can be settled immediately. Intelligent and full use of the instruments provided is essential to get the best results, and the ordinary foundry workman can be trained to do a really good job of work in this connection.

The recording of the day's melt and all possible factors from the control data is desirable, as this does enable unusual conditions to be investigated and compared with past melts, and certainly helps to tighten up on cupola practice. It is thought that the method of registering a solid movement, together with the comments on the preheating zone, are very important indeed. All these factors assist in giving uniform total carbon figures, which are often difficult to maintain on small-sized cupolas.

Investigation on Lining Wear

It has been pointed out how necessary it is to adhere to standard optimum operation conditions of the cupola, and having overcome the air-control factor, the next major variable was the inside lining size.

With the Pari-blast, the interior lining wear was per-



× 100—Crossed Nicols. × 100—Unetched.

Fig. 12.—Section Showing Trapped Sand Grains.

fectly symmetrical, but the general surface after a melt was cut with furrows and lumps due to slag erosion, which must be familiar to all cupola men. Some eight or more different ganisters were tried out to get a better lining, but even the most expensive types tended to run in the heating zone. Another factor which must also be familiar to operators was the variations in each batch of ganister from the same supplier.

Ronceray some 20 years ago added coke to his cupola patching, and it was thought that this might afford an improvement on the patching material in use. Various percentages of coke were tried, and 10 per cent. by weight showed a very considerable improvement.

A quantity of good-quality ramming ganister was milled with 15 per cent. of crushed furnace coke, and sufficient water was added to give a workable mixture with a moisture content of 6 per cent. This material was rammed above a tuyere covering an area of about 2 ft. square. The rest of the cupola was lined with the ganister without the coke addition. After drying and use, this was examined, and it was found that the coke mixture surface was much more even, showed less wear, and presented a bubbly appearance (Fig. 13). The rest of the cupola walls were badly fused and had the familiar uneven humpy appearance. This experiment was repeated several times, and samples were cut out of the lining after use (Fig. 14); very little actual fritting had taken place and most of the coke particles were intact as unburnt coke.

A piece of normal ganister cut from diametrically opposite the experimental patch composed showed quite a different structure. The coke mix was cellular, whereas the normal ganister was dense and had obviously fritted to a depth of 1½ to 2 in. This depth must be plastic when the cupola is in use, and is one of the chief causes of bridging since the coke embeds itself into the wall and gradually builds up.

The coke percentage was gradually increased to 20 per cent. and then the results were bad, and it appeared necessary to include a finer material to prevent the coke burning out before the material glazed on its surface. All the ganisters supplied were erratic in mesh sizes even from the same source, and this appeared to be giving trouble.

The following table shows the grading of four ganisters tried out:—

Per cent. Retained.

	+5	+8	+10	+16	+22	+30	+44	+60	+100	+150	+200	−200	Clay.
A	Nil	2.3	1.6	6.7	3.7	4.5	6.7	21.5	14.3	4.8	2.1	8.8	23.0
B	—	—	—	—	—	—	—	0.2	20.8	39.1	3.0	7.9	28.0
C		26.0	2.4	4.8	2.1	1.6	Nil	3.6	5.4	5.9	6.0	15.6	26.6
D	1.8	9.4	4.0	7.3	3.5	1.5	1.0	1.6	4.3	19.4	16.7	11.8	17.7

The material can hardly be expected to ram similar densities.

Three more ganisters were tried out in an endeavour to find a material which would give a good average on mechanical analysis; this did not seem to be easily obtainable, so two types of material were obtained, mixed experimentally, until they gave a reasonable percentage on all sieve sizes. The developments took over 12 months, due to trying out all types of fine ganister, coarse and fine materials, and the undermentioned is the mixture proved most satisfactory, with a moisture content of 7 per cent.

A typical sieve analysis of the mixture in use is:—

Per cent. Retained.

	+5	+8	+10	+16	+22	+30	+44	+60	+100	+150	+200	−200	Clay.
		3.4	0.8	3.2	2.8	5.0	9.6	15.0	9.8	5.8	3.6	12.4	28.6
Coke.		2.2	1.2	1.4	1.1	1.5	1.3	1.2	1.6	1.0	0.6	1.2	0.6

The coke percentages were obtained by the loss of ignition on each mesh size.

It is interesting to note that this material had no contraction on air drying; the average contraction on ganisters is approximately 1.5 per cent., the dried-out lining shows no signs of cracking.

To crush hard cupola coke into small particles was a prolonged and tedious operation, and it was suggested by Mr. J. J. Sheehan that coke dust from the gasworks, which was very cheap and required no crushing, would probably serve the same purpose. This material was used after the first few tests and appears to be quite satisfactory. With the finer material being used, the percentage of coke could be increased to a maximum of 17½ per cent. and still give very good results. At this time, following normal practice, the superheating zone was being rammed round a steel template, and the results were good; so it was decided to try out patching instead of ramming. Although the wear was not quite as good as the rammed lining, it was good enough to hold the internal diameter within the limits set, and it is now standard practice.

From the moisture content of the material (7 per cent.) it will be gathered that this is on the dry side, but the best results are obtained with this moisture content. It is essential to chip off all traces of slag and the previous glaze, otherwise the material will peel off. The wall is then coated with a fireclay slurry, and the ganister applied to the wall and rammed as hard as possible with a lead dresser. The men appear to use this dresser better than one or two tools which were made for them, one of which takes the form of a knuckle-duster with a flat face. After the lining is completed it is given another light coating of fireclay slurry, which helps to avoid the coke burning out when the cupola bed is burning up.

Balanced Air Feed in the Cupola

Two cupolas are operated on alternate days, and one only is patched each week-end, so that before the cupola is refettled, it has been used for five melts.

The effect of the slag on some high-quality ganisters is to lower the refractory value considerably, and an endeavour has been to make up a mixture that would resist slag erosion as much as possible.

Some of the early coke mixtures showed a glaze of only $\frac{1}{16}$ in., but probably, in common with some of the

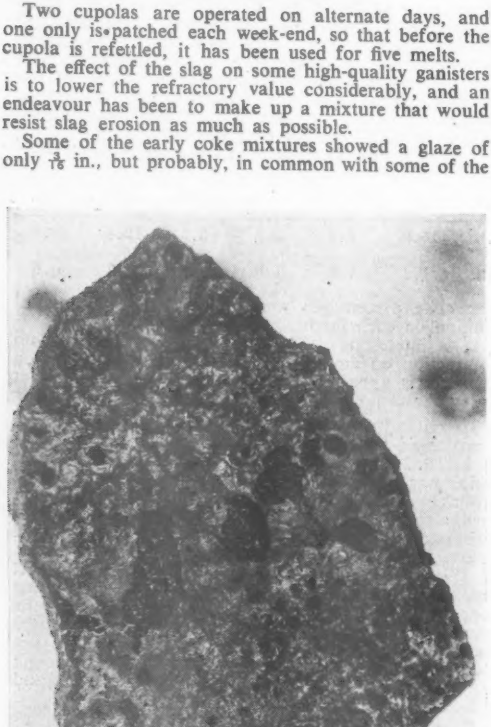


FIG. 13.—APPEARANCE OF USED LINING CARRYING 15 PER CENT. CRUSHED COKE.

rammed linings, they tended to spall and, having a rather weak backing, tended to break up. Adding the finer grade ganister corrected this trouble and, as mentioned above, it was found that more coke could be incorporated and better wear figures obtained.

This investigation on linings should go on; many foundries could experiment with similar mixtures adjusted to their particular requirements. If the information could be correlated, it would undoubtedly be of considerable interest and value to the foundry industry.

Summary

From experience gained, the Authors are able to state that the factors exercising the greatest influence upon the operating conditions of small-sized cupolas are the lining condition and cross-sectional area just above the tuyeres.

The lining developed has better wear-resisting properties than that of normal ganisters; the diameter increases but slightly, enabling the cupolas to be run daily very close to their optimum conditions. Maximum possible density must be aimed at. Lining materials taking a

FIG. 14.—TWO VIEWS OF GANISTER PLUS 15 PER CENT. COKE LINING AFTER USE.

very small depth of glaze give very little softening of the lining, with a result that bridging is almost non-existent, and there is a full bore movement of the charges. Temperature and barometric pressure have a secondary effect and the air supply can be readily adjusted accordingly. Controlled melting conditions give maximum efficiency from the coke and air put into the cupola.

Acknowledgments

The writers would like to acknowledge the assistance, advice and friendly criticism given by Mr. L. W. Bolton, Mr. J. J. Sheehan and Mr. W. B. Parkes, and to thank the directors of the Idoson Motor Cylinder Company, Limited, Smethwick, for permission to publish this information.

MR. G. G. IBBOTSON, general manager of the heavy construction division, ironworks branch, of Newton Chambers & Company, Limited, has been appointed a local director of the company.

TEXTILE MACHINERY INDUSTRY

HOME AND EXPORT PROSPECTS

As a contribution to the understanding of Britain's post-war problems, P.E.P. have undertaken a study of the engineering industries. This is a very large field, and the first section to be tackled covers only one comparatively small industry, the manufacture of textile machinery. The preliminary results of their work are summarised in the latest P.E.P. broadsheet.*

Although the gross output of the textile machinery industry before the war averaged less than 10 per cent. of the total for the mechanical engineering industries as a whole, more than half of it was exported, and this gives the industry special importance at the present time. P.E.P. examine the world market for textile machinery and give some tentative estimates of demand. They point out that the inability of textile manufacturing countries to obtain replacements of machinery during the war has given rise to a very large accumulated demand, estimated at an annual figure for the next decade of £150-£200 million at present prices. Even in terms of weight, this is probably three to four times as great as the demand in 1929, the last year of "normal" trade. The reduction in the productive capacity of Germany and Japan, and the pre-occupation of the U.S.A. with its domestic market, mean that for the time being the task of satisfying this demand will fall in the main on the British industry.

Productive Capacity

In view of the need to encourage exports with favourable long-term prospects, Britain would be well advised to devote a large share of capacity to production for export. But, if the home market is not to be starved, a considerable increase in the total productive capacity of the industry will be necessary. The needs of the British textile industry (particularly the cotton section) for new machinery are also very large, and will be even larger if the recommendations of the Platt Report —supported in the main by the Government's Cotton Working Party—are to be implemented. P.E.P. estimate that the average yearly demand in the home market is more than 100 per cent. greater than it was before the war.

The chief obstacle to expansion is shortage of labour. P.E.P., therefore, conclude that a significant expansion of production can only be achieved by raising the productivity of the present labour force. At the moment this is low, due in the main to inadequate mechanisation and lack of standardisation, particularly in the foundries. Far too many small firms are engaged on the production of different types of machine for work on identical fibres. These small firms have a conservative outlook, and lack the resources to finance the schemes of modernisation which are necessary, P.E.P. state.

Summing up the results of their study, P.E.P. make the following recommendations:—

(*a*) That machine shops and foundries should be mechanised—greater mechanisation should raise the productivity of labour, and at the same time create the better conditions of work and pay which will help to attract new recruits to the industry.

(*b*) That the average size of producing unit, particularly at the foundry level, should be increased. This could be done by the amalgamation of some of the smaller units, and by the setting up of a few large foundries, fully mechanised, each serving several firms.

(*c*) That the product should be as far as possible standardised. The manufacture of an unnecessarily large variety of machines makes heavy demands on skilled labour, and restricts the possibilities of using automatic machine tools.

* No. 252, "The Textile Machinery Industry," obtainable from P.E.P. ("Political and Economic Planning"), 16, Queen Anne's Gate, London, S.W.1, price 1s. 7d. post free.

BELGIAN FOUNDRYMEN VISIT DARLINGTON WORKS

A delegation of prominent Belgian foundrymen, visiting this country at the invitation of the Government, recently visited the steel foundry of Thomas Summerson & Sons, Limited, Darlington, where they were conducted round by Mr. T. H. Summerson, chairman, and Mr. H. P. R. Scott, managing director. In the evening, the directors of the company entertained the delegation at a dinner, which was attended also by representatives of many North-East Coast steel foundries.

The Belgians were much impressed with what they saw in the foundry, and commented on the high degree of mechanisation and the quality of the products. "We have nothing to equal it in Belgium," was the comment of M. R. Richard, leader of the delegation. The healthy working conditions also impressed the visitors. Thomas Summerson & Sons are spending £150,000 on further mechanisation and various improvements to the foundry, which, it is expected, will result in an overall increase in production of 70 per cent.

The Belgians also visited the works of the Davy & United Roll Foundry, Limited, at Haverton Hill.

NEW IRON AND STEEL SCRAP ORDER

The Minister of Supply has made the Control of Iron and Steel (No. 51) (Scrap) Order, 1946, which comes into force on Monday. The Order increases the maximum prices of iron and steel scrap to meet the recent increase in rail freight rates. The increases vary from 5d. to 1s. 6d. a ton, according to the district. Copies of the Order may be obtained from H.M. Stationery Office, Kingsway, London, W.C.2, or through any bookseller, price 1d. (S.R. & O. No. 1101, 1946).

ALAR DATA SHEET 00.12, deals with Alar 00.12 aluminium silicon casting alloy. It details the chemical composition, mechanical and physical properties, strength at elevated temperatures, machinability, corrosion resistance, anodising, casting characteristics, heat-treatment, and the application. Copies of this and other data sheets are available to readers from Alar, Limited, 35, New Broad Street, London, E.C.2.

PROPOSED DEVELOPMENTS AT G.K.N. WORKS

MORE THAN £4,000,000 TO BE EXPENDED

At an extraordinary meeting of the shareholders of Guest, Keen & Nettlefolds, Limited, last week, resolutions were duly passed approving an increase in the authorised ordinary capital from £8,000,000 to £13,000,000. As stated in our issue dated July 11, it is proposed to issue 2,256,630 £1 ordinary shares at 34s. per share to ordinary stockholders in the proportion of one new share for every £3 of ordinary stock then held.

Proceeds of the issue will go towards meeting development expenditure at the works of the company and its subsidiaries, amounting to approximately £4,200,000, and divided as follows:—At the directly-owned works of Guest, Keen & Nettlefolds, Limited, £1,000,000; at the works of wholly-owned subsidiary companies, other than iron and steel producing companies, £2,000,000; at the works of John Lysaght, Limited, in respect of work already proceeding for increasing iron and steel production, and cheapening costs in the finishing departments, £1,200,000.

The total expenditure envisaged at the works of John Lysaght, Limited, is of much greater amount than that shown above, but consideration of the method of providing the funds to meet the remainder of the programme there, which is for new blast furnaces, rolling mills, etc., has been deferred until the Government's proposals, financial and otherwise, in regard to the nationalisation of portions of the iron and steel trade, become clearer.

The greater part of the expenditure for which the proceeds of the issue are to be used will be incurred at the directly-owned works of the company (not steel producers) and at the works of those subsidiaries whose activities can be classified as engineer and fabrication industries or furnishing those industries with their supplies.

Extensions to Screw Works

Of the expenditure at the directly-owned Guest, Keen & Nettlefold works, about half, namely £500,000, will be incurred at the screw works in Birmingham for additional factory space and buildings to improve engineering and warehousing facilities, with further improvements in screw-making machinery. The bolt and nut works at Darlaston, which is the largest of its kind in this country, also has a programme for further improvement of its machinery.

The sum of over £250,000 will be utilised for developments at the Castle Works, Cardiff, and the re-rolling mills there. At the other directly-owned works at Cwmbran, in Monmouthshire, it is proposed to mechanise the foundry in order to cut the cost of production and to develop the manufacture of an improved type of composite sleeper for railway track.

The expenditure sanctioned or proceeding for nine subsidiary companies (other than John Lysaght, Limited) will require about £2,000,000, of which three-quarters will be called for by two of them. The developments in subsidiary companies include the following projects:—A new factory for production of butts and hinges; a large new fitting shop for construction and maintenance of plant for the G.K.N. group of companies; increased production of railway fastenings and fittings for steel scaffolding; purchase of a factory built under Government auspices for increased production of forgings; manufacture of high-grade tools; increased production of pressed steel wheels for motor lorries, passenger cars, agricultural tractors and ploughs, and wheelbarrows, etc.; production of chassis frames.

JUNE PIG-IRON AND STEEL PRODUCTION

Steel production during the second quarter of 1946 was at the rate of 13,111,000 tons a year. This is an increase over the figure of 12,617,000 tons for the first quarter of 1946 and compares with 11,814,000 tons in the second quarter of 1945. Production during June slightly exceeded the figure for June last year, although it was curtailed by the Whitsun holiday, whereas in June, 1945, there were no public holidays.

Pig-iron output during the second quarter was at the rate of 7,827,000 tons a year, compared with 6,894,000 tons in the corresponding period of 1945. June production was at the rate of 7,878,000 tons a year, compared with 6,916,000 tons a year ago. Pig-iron output was not significantly affected by public holidays.

The table below shows the June production with previous figures for comparison:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1946—1st quarter ..	145,500	7,566,000	242,600	12,617,000
April	148,700	7,732,000	252,100	13,111,000
May	151,200	7,860,000	261,900	13,619,000
June	151,500	7,878,000	239,900	12,475,000
2nd quarter ..	150,500	7,827,000	252,100	13,111,000
1945—1st quarter ..	134,500	6,992,000	233,200	12,126,000
April	137,600	7,154,000	236,600	12,302,000
May	128,200	6,668,000	210,800	10,962,000
June	133,000	6,916,000	238,300	12,392,000
2nd quarter ..	132,600	6,894,000	227,200	11,814,000

OBITUARY

MR. CHARLES M'KINLAY DUNCAN, late of P. MacCallum & Sons, Limited, iron and steel and scrap merchants, etc., of Greenock, died on July 12.

MR. FRANCIS STEPHEN PILKINGTON, manager of the welding department of Charles D. Holmes & Company, Limited, engineers, boilermakers, etc., of Hull, died on July 12, aged 54. He had been with the firm for 30 years.

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NEWS IN BRIEF

IMPERIAL CHEMICAL INDUSTRIES, LIMITED, announce that the address of their southern region sales office is now Gloucester House, 149, Park Lane, London, W.1.

THE FIRST POST-WAR FACTORY to be completed on Tees-side was officially occupied by Allan Kennedy & Company, Limited, late of Vulcan Street, Middlesbrough, whose address, accordingly, is now Maritime Road, Stockton-on-Tees. The factory is devoted to the manufacture of steel flooring.

PATERSON HUGHES ENGINEERING COMPANY, LIMITED, announce that a separate company has been formed in South Africa under the title of Paterson Hughes Engineering S.A. (Pty.), Limited, P.O. Box 811, Johannesburg. The chairman is Mr. D. Cherry Paterson and the managing director Mr. W. Morison Philip, who was chief engineer of the parent company for many years.

THE CHANCELLOR OF THE EXCHEQUER, speaking recently at Neath, said that in different parts of South Wales at this moment 60 new factories were being built, and there would soon be more. Up to May 31 last 192 new projects for industrial development in South Wales had been approved, at an estimated cost of over £10,000,000, to give additional direct employment to more than 54,000 workers.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION, of 36 & 38, Kingsway, London, W.C.2, have sent us a memorandum entitled, "The British Electric Welding Industry." It covers arc welding electrodes and welding plant, giving much detail as to statistics, research and overseas trade. Resistance welding machines are similarly treated. It is available to our readers on writing to the Publication Department of the B.E.A.M.A.

THE APPLEBY-FRODINGHAM STEEL COMPANY, LIMITED, has been placed in voluntary liquidation by means of a members' voluntary winding-up, with a view to its absorption by the United Steel Companies, Limited, as the beneficial owners of the entire issued capital of the company, and who will carry on the business as a separate department of the United Steel Companies. The procedure is purely formal, and all debts due to and owing by the company will be recovered and paid in the usual way.

THE ANNUAL REPORT OF the General Electric Company, Limited, states that a large volume of orders has been received, leaving the order-book at the close of the year in a strong position, but the cancellation of Government contracts and labour shortages have created difficult problems in their factories. Export business is increasing rapidly, and all operating overseas companies have shown good results. Those companies which were located in enemy-occupied territory have recommenced operations since the close of the year.

IN A MESSAGE to the Conservative candidate in the Pontypool by-election, Mr. Winston Churchill said that the Government's planning had resulted in the production not of practical schemes, but of viewy outlines, including a formal threat to nationalise the iron and steel industry which disclosed hardly the vaguest conception of how the Government proposes to set about it. The Government's declaration had had the immediate effect of freezing all practical plans for the further development of this vital and now buoyant basic industry.

EMPLOYMENT FOR AN ADDITIONAL 400 people will be found by Johnson & Phillips, Limited, manufacturing electrical engineers and cable makers, at their factory at Carfin, Lanarkshire, when plans, now being put into operation, are completed. The company bought the factory from British National Electrics, Limited, early in the year. They are continuing to manufacture and market the products of that company and have decided, in addition, to concentrate the production of domestic appliances at Carfin, and leave their factory at Charlton, London, S.E.7, to concentrate on cables and heavy equipment.

THE PROBLEMS OF TO-DAY demanded that the most careful attention should be given to everything which would increase the efficiency of their operations and improve the output per man-hour, said Mr. G. R. Sharpley (chairman) in his speech at the annual meeting of Ruston & Hornsby, Limited. Their programme included a very considerable extension to their Lincoln foundries. These factors, combined with the effect which inflation had had on working capital, had decided their directors to take steps to increase the issued share capital of the company. Treasury consent had already been obtained, and the directors proposed to issue a further 410,000 ordinary shares.

A NEW FACTORY which is to be built on the outskirts of Darlington for Patons & Baldwins, Limited, will include a novel type of roof design devised by the consulting engineers, Sir Alex. Gibb & Partners, for air-conditioning purposes, and will cover approximately 33 acres. The supply and erection of the fabricated steelwork is being carried out by the bridge and constructional works of Dorman, Long & Company, Limited, and the present order is for approximately 4,000 tons. This will be increased to 8,000 tons in the final scheme. Construction requires the despatch of the work in small sections from the fabricating shops at Middlesbrough, these sections being built up into larger units on the site.

MR. A. CALLIGHAN, general secretary of the National Union of Blast-furnacemen, assured the Council of the union at the annual meeting at Harrogate that, although the British Iron and Steel Federation would continue to oppose public ownership, they would carry on with their plans for the development of the industry, being determined not to hand over to the nation "a bankrupt industry." We could not expect the necessary legislation to be introduced in the House of Commons until the autumn of next year. There was a dangerous time-lag between the announcement of a decision to legislate and carrying the necessary legislation into effect. The shorter the period between the two the better for the country as a whole.

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COMPANY RESULTS

(Figures for previous year in brackets.)

W. G. Allen & Sons (Tipton)—Final dividend of 7½%, making 10% (same).

A. Kershaw & Sons—Net profit for 1945, after taxation, £15,698 (£15,735); no dividend (same); forward, £14,467 (£14,303).

W. H. Baxter—Profit for the year ended March 31, after tax, £5,428 (£4,632); dividend of 10% (same); forward, £982 (£394).

Bentley Engineering Company—Net profit for 1945, after tax, £25,994 (£16,882); dividend of 20%, tax free; forward, £21,772 (£17,675).

Gerrard Industries—Profit for the year ended March 31, £19,416 (£26,688); dividend of 20% and bonus of 5% (same); forward, £2,960 (£2,891).

Larmuth & Bulmer—Profit for the year ended March 31, £12,551 (£4,870); final dividend of 10%, making 12½% (10%); forward, £13,467 (£6,099).

Mirrlees Watson Company—Net profit for the year ended March 31, after depreciation and tax, £16,516; dividend of 8% (same); forward, £9,160 (£15,413).

Kelsey-Hayes Wheel Company—Profit for the year ended August 31, after expenses, depreciation, taxation, etc., £16,207; no dividend; forward, £126,574 (£110,367).

General Electric Company—Net profit for the year ended March 31, £1,376,413 (£1,303,119); dividend of 10% and bonus of 7½% (same); forward, £991,790 (£964,270).

Permutit Company—Net profit for 1945, £24,356 (£20,662); dividend of 10% (same) and bonus of 2½% (same); written off patents and licences, £527 (nil); forward, £38,396 (£22,752).

Warne, Wright & Rowland—Profit for 1945, £17,483 (£18,712); contingencies, nil (£3,000); general reserve, £8,000 (£5,000); final dividend of 17½%, making 25%; forward, £19,317 (£18,503).

Allied Ironfounders—Net profit for the year ended March 31, £242,494 (£214,362); to general reserve, £43,927 (£40,000); final dividend of 7½%, making 12½% (same); forward, £303,442 (£256,354).

Yorkshire Copper Works—Net profit for 1945, £78,768 (£71,155), plus £30,000 provision for taxation no longer required; dividend of 10% and bonus of 5% (same); forward, £22,610 (£21,214).

Anderston Foundry Company—Profit for the year ended March 31, after depreciation, income-tax, N.D.C., E.P.T., and Workmen's Compensation, £28,876; final dividend of 9s. per share, making 11s.; forward, £6,789.

Thomas Bolton & Sons—Profit for the year ended March 31, £41,746 (£217,383); to tax, £21,150 (£138,152); to general reserve, nil (£10,000); to contingencies, nil (£30,000); dividend of 7½% (10%); forward, £68,699 (£75,603).

William Baird & Company—Trading profit for the year ended May 31, £341,668 (£342,655); net profit, after meeting debenture interest and tax, £171,636 (£165,781); final dividend of 11%, making 15% (same); forward, £158,447 (£138,975).

John Brown & Company—Net profit for the year ended March 31, £407,264 (£403,181); depreciation, £57,374 (£62,464); debenture and other interest, £19,995 (£63,639); to reserve, £75,000 (nil); dividend of 10%, tax free; forward, £238,809 (£224,070).

Glacier Metal Company—Profit for the year ended February 28, £78,278 (£85,057); to income-tax and E.P.T., £35,412 (£76,020); general reserve, £22,000 (nil); preference dividend, £3,895 (£2,750); ordinary dividend of 7½% (same); forward, £20,670 (£11,516).

Hallamshire Steel & File Company—Trading profit for the year ended March 31, after depreciation and E.P.T., £36,321 (£39,067); tax, £14,497 (£16,486); depreciation of investments, £4,000 (nil); contingencies, £2,500 (£7,500); final dividend of 1s. 9d. per share, making 2s. 6d., tax free (same); forward, £14,094 (£12,530).

CONTRACTS OPEN

Any date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Carnoustie, August 5—Supply and laying of 1,319 yds. of gas mains, for the Town Council. Mr. J. M. Ireland, gas manager, Carnoustie.

Cradley Heath, August 9—Supply, erection and setting to work of eight rotary distributors for circular filter beds, 8 ft. dia., together with cast-iron feed and wash-out pipes, valves and accessory fittings and incidental apparatus, for the Upper Stour Valley Main Sewerage Board. Mr. G. P. Deeley, 13, Church Street, Stourbridge. (Fee £5 5s., returnable.)

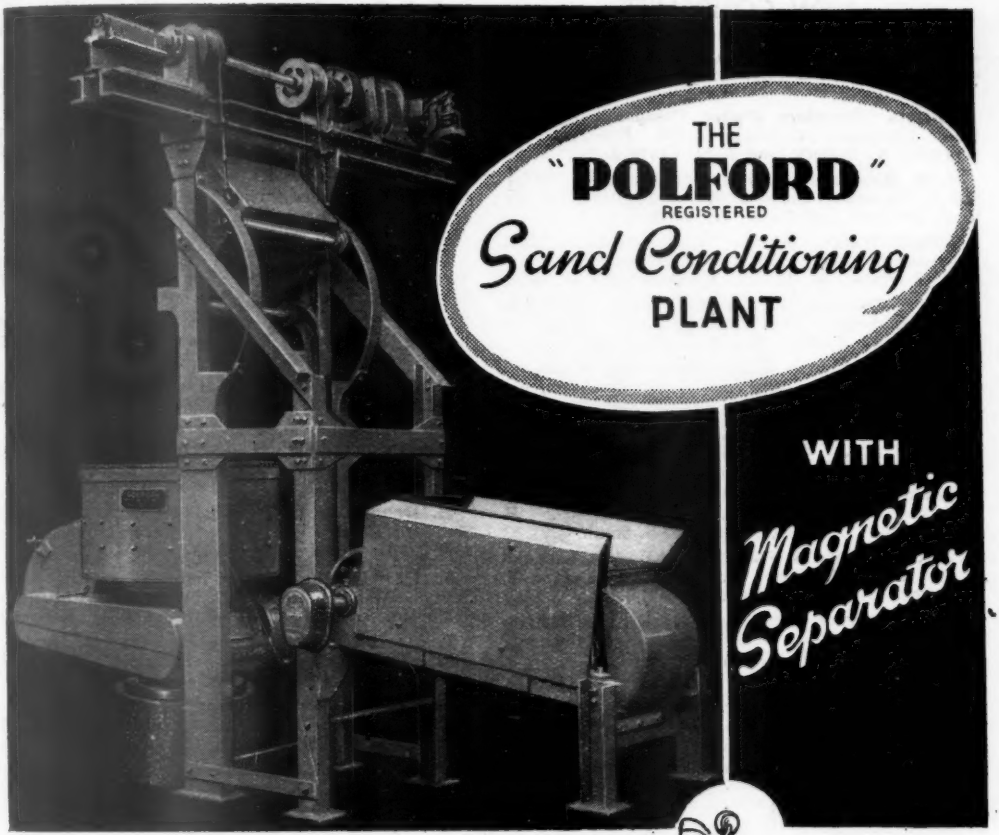
Darton, July 31—Providing and laying approx. 1,533 yds. of 5-in. and 1,400 yds. of 4-in. spun-iron, concrete-lined water pipes with flexible screwed gland joints, together with valves, fire hydrants, specials and cast-iron surface boxes, for the Urban District Council. Mr. P. Wilkinson, surveyor and waterworks, engineer, Council Offices, Darton, near Barnsley.

Denton, August 28—Supply and erection of sewage pumping plant, for the Urban District Council. G. B. Kershaw & Kaufman, consulting engineers, Victoria Street, Westminster, London, S.W.1. (Fee £5 5s., returnable.)

Leyburn, August 12—Provision and laying of 4,500 yds. of 3-in., 2-in. and 1¼-in. spun-iron and galvanised pipes, together with the construction of break pressure tank and valve chambers, for the Rural District Council. Mr. W. K. Rodwell, engineer, 44, Park Cross Street, Leeds, 1. (Fee £2 2s., returnable.)

RAYMAKERS & SONS (ENGINEERS), LIMITED, is being wound up voluntarily. Mr. H. B. Britcliffe, 42, Abbey Street, Accrington, is the liquidator.

PAT. No. 570997.



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NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Cannock Chromium Plating Company, Red Hill House, Chadsmoor, Cannock—£1,000. F. Horrocks, F. Williams, A. Bullock, and J. H. Corfield.

D. R. Robertson, 1, Grosvenor Gardens, London, S.W.1—Engineers, etc. £2,000. D. R. Robertson, R. S. Williams, and D. G. W. Y. Brown.

Willard Works, Willard Works, Willard Street, Wandsworth, London, S.W.18—Engineers, etc. £3,000. H. J. Rayment, W. H. and J. Gascoigne.

E. & A. Chesstok, 2, Trocadero Buildings, Wilmslow Road, Rusholme, Manchester—Metal goods manufacturers, etc. £1,000. E. and A. Chesstok.

Esjayess, Worcester Road, Upton Warren, Bromsgrove, Worcs—Manufacturers of machine tools, etc. £500. T. P. Jones, W. G. and H. G. Smith.

Overhill Gears (Holdings), 1, Westover Mansions, 13, Gervis Place, Bournemouth—£500. G. Williams, C. J. Dallimore, R. Tilley, and A. C. Clark.

Modern Machine Development, Spring Vale Works, Whittaker Street, Chadderton, Oldham—£2,000. F. and R. I. Burr, E. R. Connelley, and S. Smith.

Jonas Woodhead & Sons (Scotland), 177, Kirkstall Road, Leeds, 4—Engineers, etc. £100. A. G. Kyle, G. Kettlewell, H. R. Carver and J. Templeton.

Charles Pallister, Rex House, 38, King William Street, London, E.C.4—Dealers in metals, residues and ores. £10,000. C. Pallister and W. M. Paul.

G. W. G. Cooke & Sons, 64, Craven Park, Harlesden, London, N.W.10—Engineers, press-tool manufacturers, etc. £350. G. W. G. and M. Cooke.

Pneuspeed, Danes Inn House, 265, Strand, London, W.C.2—Tool, pattern and machinery designers, engineers, etc. £1,000. J. A. Dick and E. J. Jofeh.

Humphris Metalcraft, Park House, Parkstone, Dorset—£9,000. Baron Huntingfield, Baroness Huntingfield, G. F. and J. F. Humphris, and H. Keith.

Rhymney Engineering Company, Powell Duffryn House, Bute Street, Cardiff—£100,000. E. L. Hann, I. Williams, Sir G. C. Usher, and P. G. Penny.

West of England Metal Industries, Morley Road, Merrywood Road, Southville, Bristol, 3—£3,000. A. H. and R. V. C. Harvey and E. S. F. Wilkins.

John Downton Foundry & Engineering Company, Chipka Street, London, E.14—£25,000. A. Wright, N. S. Hindley, W. H. S. Aplin, and G. F. Wright.

Anchor Engineering & Sheet Metal Company, Anchor Works, Upper Green, Newcastle-upon-Lyme—£1,000. J. S. Heath, R. G. Swift, and C. Fairhurst.

Wultex Machine Company, Progress Works, Upper Bankfield Road, Moldgreen, Huddersfield—£2,000. J. W. Roberts, E. Womersley, and G. Richmond.

A. V. Perry & Company, 26, Hill Crest Road, Gt. Barr, Birmingham, 23a—Engineers, etc. £1,000. A. V. and F. I. Perry, W. J. Mellor, and F. W. Stocker.

Merlin Construction Company, 10a, High Street, London, S.E.25—Ironfounders, engineers, etc. £1,000. G. R. Bennett, S. E. Whiteley, and L. J. Thomas.

Building Component Producers' Association, 31-33, High Holborn, London, W.C.1—J. L. Brockhouse, J. E. Steel, G. R. Barclay, N. Carr, and C. H. Gardiner.

John M. Perkins & Smith, High Street, Braunston, near Rugby—Mechanical engineers, etc. £4,000. J. M. Perkins, C. A. Smith, and B. M. Walderson.

Carlton Chrome, 131, Victoria Street, London, S.W.1—Metallurgists, platers, etc. £1,000. W. Smirk, M. S. Black, D. Havilland-Roe, and E. V. Simmons.

Ritson Construction Company, 8, Ritson Road, London, E.8—Ironmasters, ironfounders, etc. £2,000. W. A. Robertson, W. J. Childs, and H. J. Murrells.

Heathcott Staite, Cordwallis Works, Cordwallis Road, Maidenhead—Mechanical and general engineers, etc. £3,000. E. Heathcott and H. G. Staite.

Worthing Mechanical & Engineering Company, Liverpool Chambers, Liverpool Gardens, Worthing—£1,000. F. W. and E. F. Shaw, and F. J. Chapman.

H. Dunning & Company (1946), Stamford Works, Stamford Road, Audenshaw—Engineers, founders, etc. £1,000. H. Dunning, W. Hawke, and J. F. Sharples.

J. H. McBell, Boutells Farm, Lamarsh, Bures, Suffolk—Manufacturers of bulldozers, excavators, machinery, etc. £1,500. J. Elford and M. J. Powell.

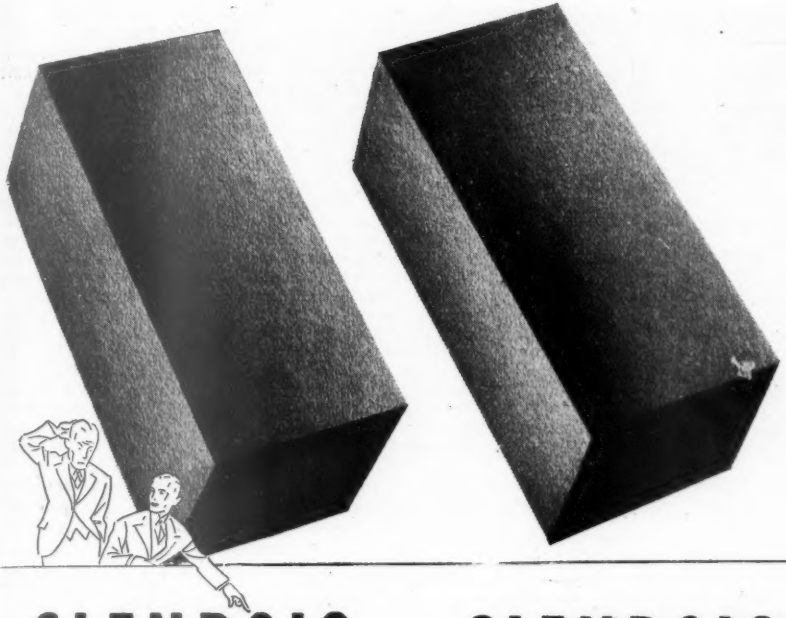
T. E. Trenchard & Company, Harbour Road, Lydney, Glos.—Engineers, founders, etc. £1,200. T. E. Trenchard, E. G. Hancock, W. G. and G. G. Phillips.

Overhill Engineering Company, 1, Westover Mansions, 13, Gervis Place, Bournemouth—£2,000. G. Williams, C. J. Dallimore, R. Tilley, and A. C. Clark.

Frank Rigg, Don Works, Yorkshire Street, Rochdale—Engineers and press-tool makers. £7,000. C. F., R. C. S., and F. E. H. Shackleton and W. Waters.

U.S. STEEL PRICES

While the U.S. steel industry may soon raise the prices of some steel products, this action would have taken place whether or not the Office of Price Administration passed out of existence, says the "Iron Age." It is the general view in the industry that no sharp increases in steel prices will take place in the immediate future now that all Government price controls have been removed. Our contemporary suggests that steel companies will refrain from substantial price increases for fear of public censure and the possibility that such action might hasten a revival of O.P.A. or similar legislation. Steel firms at this time are primarily interested in raising the price of those products on which the return is low. Until the current situation is clarified, no action of any kind on steel prices is expected.



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which shall we use?

IN most structures provision is made for a very high factor of safety. With firebrick structures, however, modern furnace operating temperatures are so near to the actual fusion temperature of the firebrick that only a slight safety margin is obtainable. Further, the loads to be carried by the firebricks must be considered in conjunction with the temperature and *conditions* to which they will be subjected. To assist users faced with problems concerning the selection of firebricks, temperature/load-bearing characteristic charts for "Glenboig" and "Glenboig A.I." quality firebricks are available on request. The Glenboig technical staff are pleased to make specific recommendations. Generally speaking, in high temperature furnaces the use of "Glenboig A.I." quality firebricks gives a greater margin of safety.

42/44% Al_2O_3
GLENBOIG A.I.
GLENBOIG A.I. CROWN

36/38% Al_2O_3
GLENBOIG · GLENBOIG CROWN
CASTLECARY

34/35% Al_2O_3
DYKEHEAD · GEM

GLENBOIG
FIREBRICKS

THE GLENBOIG UNION FIRECLAY CO LTD., 48, WEST REGENT STREET, GLASGOW, C.2

EXPORT AGENTS: GENERAL REFRACTORIES LTD., GENEFAX HOUSE, SHEFFIELD 10

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Raw Material Markets

IRON AND STEEL

There has been some improvement in the output of native ironstone, but the figures continue to be substantially below those of a year ago and imports of foreign ore have still to be maintained at a high level. Blast-furnace outputs are fairly steady, but, in the aggregate, are barely sufficient for current needs, and foundrymen's quotas are too restricted to permit of the replenishment of stocks.

The scrap position is not too easy. There are delays and difficulties in getting light and medium cast scrap, although the position is not so stringent in heavy cast-iron or steel scrap.

Foundries are having no difficulty just now in getting all they require in the way of ganister, limestone, etc. There is, however, a definite stringency in cupola coke. Consumers are going to have specific tonnages allocated to them, based, it is understood, on 1945-46 figures. Supplies at present coming through are just about sufficient to meet current requirements, leaving no margin for stock.

Expectations of more liberal imports of steel semis are not encouraged by the ratification of the American loan agreement. U.S. producers have little material to spare for export and prices, swollen by high transport charges, are prohibitive. Re-rollers are therefore making extensive use of scrap and defective material. The pressure for sheets is intense, and although the mills have hitherto been adequately supplied with slabs, it is suggested that imports of sheet bars will have to be resumed to keep the mills in full operation.

The apparently well authenticated reports that the Ministry of Supply is contemplating a rise in steel prices has given a further impetus to the demand for finished steel. Deliveries are already in arrears and consumers are keen to obtain supplies before the price goes up. There is, however, little chance of any acceleration of deliveries, as the congestion of orders is becoming more pronounced. Steel plates, light and heavy sections, and steel rails are all heavily specified, wire and rod mills have a formidable volume of work in hand, and tube makers have as many orders as they can handle over the next few months.

NON-FERROUS METALS

The tone of the international copper market has developed very firmly following the strike of artisans at the Rhodesian copper mines of Mufulira, Nchanga Consolidated, Rhokana Corporation, Roan Antelope and Rhodesian Broken Hill, and the stoppage of production. Metal available for export in the United States is now being quoted at 16 cents per lb. f.a.s., compared with the recent quotation of 15 cents.

It is understood that an announcement of a higher price for tin payable by the Ministry of Supply to Malayan and Nigerian producers is being delayed further by the Bolivian revolution.

Supplies of zinc are adequate and consumers experience no difficulty in covering their requirements, but the forward position is less reassuring, as there is no information as to how far the authorities have provided for future needs.

Commenting on the lead side of their business at the annual meeting of Goodlass Wall & Lead Industries, Limited, Mr. C. Cookson, chairman, said the dominating factor in the immediate future was that of the supply of lead. World production had fallen and, on the other hand, the demand, particularly in America, was exceptionally high. The volume of business that they could maintain would be governed by the availability of their chief raw material. It was unfortunate that because of the shortage they were unable fully to meet the requirements of their customers not only at home but also in export markets where their trade had been for many years firmly established. In his opinion, the reopening of the London Metal Exchange as soon as practicable would be in the national interest. From their point of view the exchange had two great merits. In the first place, the effect of fluctuations in price on their trading and manufacturing activities could be reduced to a minimum by using the hedging facilities which the exchange provided, and, further, it enabled them, and every lead consumer in the country, to obtain lead at any time at the world market price

INCREASED EMPLOYMENT IN HOME AND EXPORT INDUSTRIES

The Ministry of Labour's figures for May indicate that the number of men and women employed in manufacture for the home market increased during that month by 144,000, compared with 127,000 in March. At the end of May there were 649,000 more than before the war in the metal and chemical industries, engaged to a large extent on the re-equipment of industry. Employment for export increased by another 30,000 during the month and was no fewer than 276,000 above the pre-1939 figure. The total number employed in industry during May increased by 178,000, but is still 1,120,000 below the mid-1939 figure of 17,920,000. There was a decrease of 100,000 in the total working population, which is now only 571,000 greater than in 1939, having fallen by 1,248,000 since June of last year.

The unemployment figures show another slight increase of 1,291 between May 13 and June 17. The total increase includes an increase of 12,861 in the number of men and a decrease of 11,146 in the number of women.

ADSWOOD FOUNDRY, LIMITED, is being wound up voluntarily.

A CONTRACT FOR tramway equipment, amounting to £156,000, has been placed by Glasgow Corporation Transport Department with Metropolitan-Vickers Electrical Company, Limited.

YOU'LL BE CASTING TO FINE LIMITS...

Close limits in foundry castings means faster machine shop production . . . accurate cores . . . easier working . . . reduced fettling . . . quicker drying . . . higher permeability . . . low and less objectionable gas evolution . . . and for lower true cost.

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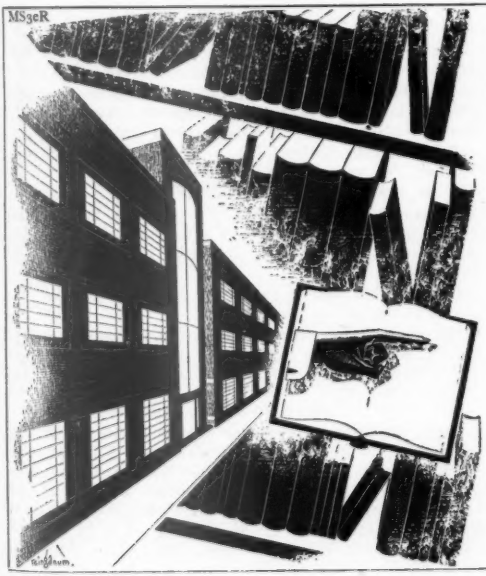

ANSWERED ALREADY

It often happens that our advice is sought on questions that have been answered in advance, and we have only to send our enquirer one of the numerous technical publications which we have issued during the past fifteen years. Of course, many other problems never reach us because our publications are already at hand. You too can have the answer on your shelves.

THE MOND NICKEL COMPANY LTD.

GROSVENOR HOUSE, PARK LANE, LONDON, W.1

CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, July 24, 1946

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, 163s.; Birmingham, 165s.; Falkirk, 163s.; Glasgow, 166s.: Manchester, 168s. DERBYSHIRE No. 3: Birmingham, 165s.; Manchester, 168s.; Sheffield, 162s. 6d. NORTHANTS No. 3: Birmingham, 162s. 6d.; Manchester, 166s. 6d. STAFFS No. 3: Birmingham, 165s.; Manchester, 168s. LINCOLNSHIRE No. 3: Sheffield, 162s. 6d.; Birmingham, 165s.

(*No. 1 foundry* 5s. *above No. 3. No. 4 forge* 1s. 6d. *below No. 3 for foundries,* 3s. *below for ironworks.*)

Hematite.—Si up to 3 per cent., S & P over 0.03 to 0.05 per cent.: Scotland, N.-E. Coast and West Coast of England, 173s. 6d.; Sheffield, 179s.; Birmingham, 185s.; Wales (Welsh iron), 169s.; East Coast No. 3 at Birmingham, 184s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 175s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 164s. 9d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 200s.; South Zone, 202s. 6d.

Refined Malleable.—North Zone, 210s.; South Zone, 212s. 6d.

Cold Blast.—South Staffs, 277s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than* 0.75 *per cent., are subject to a rebate of* 5s. *per ton.*)

FERRO-ALLOYS

(*Per ton unless otherwise stated, basis* 2-*ton lots, d/d Sheffield works.*)

Ferro-silicon (5-ton lots).—25 per cent., £21 5s.; 45 per cent., £21 10s.; 75 per cent., £29 15s. Briquettes, £26 per ton.

Ferro-vanadium.—35/50 per cent., 15s. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 5s. 10d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 6s. lb.

Tungsten Metal Powder.—98/99 per cent., 6s. 7½d. lb.

Ferro-chrome.—4/8 per cent. C, £43; max. 2 per cent. C, 1s. 1½d. lb.; max. 1 per cent. C, 1s. 2d. lb.; max. 0.5 per cent. C, 1s. 2½d. lb.

Cobalt.—98/99 per cent., 9s. lb.

Metallic Chromium.—96/98 per cent., 4s. 5d. lb.

Ferro-manganese.—78/98 per cent., £19 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 12s. 6d.; tested up to 0.25 per cent. C, £12 17s. 6d.; hard (0.42 to 0.60 per cent. C), £14 5s.; silico-manganese, £18 17s. 6d.; free-cutting £15 7s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £16 17s. 6d.; case-hardening, £17 15s.; silico-manganese, £18 17s. 6d.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £14 5s.; basic hard, 0.42 to 0.60 per cent. C, £15 2s. 6d.; acid, up to 0.25 per cent. C, £17 15s.

Sheet and Tinplate Bars.—£12 2s. 6d., 6-ton lots.

FINISHED STEEL

[*A rebate of* 15s. *per ton for steel bars sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 19s. 6d.; boiler plates (N.-E. Coast), £17 17s.; chequer plates (N.-E. Coast), £18 9s. 6d.; angles, over 4 un. ins., £16 4s. 6d.; tees, over 4 un. ins., £17 4s. 6d.; joists, 3 in. × 3 in. and up, £16 4s. 6d.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £17 4s. 6d.; rounds, under 3 in. to ⅜ in. (untested), £18 8s. 6d.; flats, over 5 in. wide, £16 9s. 6d.; flats, 5 in. wide and under, £18 8s. 6d.; rails, heavy, f.o.t., £15 7s.; hoops, £19 3s. 6d.; black sheets, 24 g. (4-ton lots), £23 5s.; galvanised corrugated sheets (4-ton lots), £28 3s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 32s. 6d. f.o.t. makers' works; C.W., 20 × 14, 30s. 6d. f.o.t.

NON-FERROUS METALS

Copper.—Electrolytic, £84; high-grade fire-refined, £83 10s.; fire-refined of not less than 99.7 per cent., £83; ditto, 99.2 per cent., £82 10s.; black hot-rolled wire rods, £89.

Tin.—99 to under 99.75 per cent., £300; 99.75 to under 99.9 per cent., £301 10s.; min. 99.9 per cent., £303 10s.

Spelter.—G.O.B. (foreign) (duty paid), £50; ditto (domestic), £50; "Prime Western," £50; refined and electrolytic, £50 15s.; not less than 99.99 per cent., £52 5s.

Lead.—Good soft pig-lead (foreign) (duty paid), £55; ditto (Empire and domestic), £55; "English," £56 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £61 2s. 6d.; rolled zinc (boiler plates), ex works, £59 2s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £51 15s.

Other Metals.—Aluminium, ingots, £67; antimony, English, 99 per cent., £125; quicksilver, ex warehouse, £30 10s. to £31 5s.; nickel, £190 to £195.

Brass.—Solid-drawn tubes, 16⅜d. per lb.; brazed tubes, 19⅜d.; rods, drawn, 15d.; rods, extruded or rolled, 11½d.; sheets to 10 w.g., 13⅜d.; wire, 13½d.; rolled metal, 12⅜d.; yellow metal rods, 12½d.

Copper Tubes, etc.—Solid-drawn tubes, 16½d. per lb.; brazed tubes, 16½d.; wire, 12⅜d.

Phosphor Bronze.—Strip, 18d. per lb.; sheets to 10 w.g., 19⅜d.; wire, 19⅜d.; rods, 18⅜d.; tubes, 23½d.; castings, 22d., delivery 3 cwt. free. 10 per cent. phos. cop., £118; 15 per cent. phos. cop., £115; phosphor tin (5 per cent.), £340. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 1s. 1d. per lb. 7% to 1s. 7d. for 30%; rolled metal, 3 in. to 9 in. wide, × ·056, 1s. 7d. (7%) to 2s. 1d. (30%); to 12 in. wide, × ·056, 1s. 7½d. to 2s. 1½d.; to 25 in. wide, × ·056, 1s. 9½d. to 2s. 3½d. Spoon and fork metal, unsheared, 1s. 5½d. to 1s. 11½d. Wire, 10g., in coil, 2s. for 10% to 2s. 6½d. (30%). Special quality turning rod, 10%, 1s. 11d.; 15%, 2s. 3d.; 18%, 2s. 7d.